Carrier

50RHE 006-060

Water-Source Heat Pumps - Horizontal Units

AQUAZONE™

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HFC-407C

Installation, Operation and Maintenance Instructions

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1 - SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and electrical codes for special installation requirements.

WARNING: Electrical shock can cause personal injury or death. Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power if applicable.

2 - GENERAL

Water-source heat pump units are single-package horizontal mounted units with electronic controls designed for year-round cooling and heating. Aquazone 50RHE water-source heat pump units are designed for high-efficiency operation using HFC-407C refrigerant.

IMPORTANT: The installation of water-source heat pump units and all associated components, parts and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

3 - INSTALLATION

3.1 - Check jobsite

Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed below to prepare a unit for installation. See Table 1 for unit physical data.

Horizontal units are designed for indoor installation only. Be sure to allow adequate space around the unit for servicing. See Fig. 1 for overall unit dimensions. Refer to Fig. 2 for an illustration of a typical horizontal installation.

CAUTION: To avoid equipment damage, do not use these units as a source of heating or cooling during the construction process. The mechanical components and filters used in these units quickly become clogged with construction dirt and debris which may cause system damage.

3.2 - Check unit

Upon receipt of shipment at the jobsite, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill. Concealed damage not discovered during unloading must be reported to the shipping company within 15 days of receipt of shipment.

NOTE: It is the responsibility of the purchaser to file all necessary claims with the shipping company.

1. Verify unit is correct model for entering water temperature of job.
2. Be sure that the location chosen for unit installation provides ambient temperatures maintained above freezing. Well water applications are especially susceptible to freezing.
3. Be sure the installation location is isolated from sleeping areas, private offices and other acoustically sensitive spaces.

   NOTE: A sound control accessory package may be used to help eliminate sound in sensitive spaces.
4. Check local codes to be sure a secondary drain pan is not required under the unit.
5. Be sure unit is mounted at a height sufficient to provide an adequate slope of the condensate lines. If an appropriate slope cannot be achieved, a field-supplied condensate pump may be required.
6. Provide sufficient space for duct connection.
7. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access.
8. Provide sufficient access to allow maintenance and servicing of the fan and fan motor, compressor and coils. Removal of the entire unit from the closet should not be necessary.
9. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of unit if necessary.

10. Provide ready access to water valves and fittings, and screwdriver access to unit side panels, discharge collar, and all electrical connections.
11. Where access to side panels is limited, pre-removal of the control box side mounting screws may be necessary for future servicing.

3.2.1 - Storage

If the equipment is not needed immediately at the jobsite, it should be left in its shipping carton and stored in a clean, dry area of the building or in a warehouse. Units must be stored in an upright position at all times. If carton stacking is necessary, stack units a maximum of three high. Do not remove any equipment from its shipping package until it is needed for installation.

3.2.2 - Protection

Once the units are properly positioned on the jobsite, cover them with either a shipping carton, vinyl film, or an equivalent protective covering. Cap open ends of pipes stored on the jobsite. This precaution is especially important in areas where painting, plastering or spraying of fireproof material, etc. is not yet complete. Foreign material that accumulates within the units can prevent proper start-up and necessitate costly clean-up operations.

Before installing any of the system components, be sure to examine each pipe, fitting and valve, and remove any dirt or foreign material found in or on these components.

CAUTION: DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move units in an upright position. Tilting units on their sides may cause equipment damage.

3.2.3 - Inspect unit

To prepare the unit for installation, complete the procedures listed below:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Verify that the unit is the correct model for the entering water temperature of the job.
3. Do not remove the packaging until the unit is ready for installation.
4. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
5. Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
6. Compressors are internally isolated. Compressors equipped with external spring vibration isolators must have bolts loosened and shipping clamps removed.
7. Remove any blower support cardboard from inlet of the blower.
8. Locate and verify any accessory kit located in compressor section.
9. Remove any access panel screws that may be difficult to remove once unit is installed.

Table 1 - Physical data

50RHE		006	009	012	015	019	024	030	036	042	048	060
Cooling capacity*	kW	1.5	2.1	2.5	3.9	4.9	5.7	6.4	8.0	9.9	11.4	13.7
Cooling COP	W/W	3.3	4.0	3.1	4.6	3.3	3.4	3.3	3.3	3.7	3.6	3.4
Heating capacity**	kW	1.8	2.4	3.4	3.8	6.1	7.0	7.9	10.6	11.3	14.3	16.8
Heating COP	W/W	3.9	4.2	3.7	4.7	4.0	4.0	4.0	4.0	4.4	4.1	4.3
Pressure drop	kPa	6.8	9.9	34.3	27.0	19.1	23.7	13.9	12.2	16.3	22.3	32.5
Liquid flow rate	l/s	0.07	0.11	0.15	0.16	0.22	0.28	0.35	0.43	0.50	0.57	0.71
Compressor		One … rotary				One … reciprocating						One … scroll
Refrigerant charge R-407C	kg	0.34	0.37	0.37	0.68	0.88	0.91	1.19	1.36	1.19	1.59	2.41
Fan motor and blower		PSC type, 3 speeds										
Fan motor power input	W	30	75	75	124	150	250	373	560	560	560	746
Blower wheel size (D x W)	mm	127 x 127	127 x 127	152 x 127	152 x 127	152 x 127	152 x 127	152 x 127	254 x 254	254 x 254	254 x 254	279 x 254
Air flow	l/s	81	113	140	212	264	307	349	437	530	630	790
Water connection size (FPT)	in	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1	1
Horizontal air heat exchanger												
Dimensions (H x W)	mm	254 x 406	254 x 406	254 x 406	406 x 406	406 x 406	406 x 406	457 x 559	457 x 559	457 x 787	457 x 787	508 x 889
Total face area	m^2	0.103	0.103	0.103	0.165	0.165	0.165	0.255	0.255	0.360	0.360	0.452
Tube size	mm	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Fin spacing	mm	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.7
Number of rows		2	2	3	3	3	3	3	3	3	3	4
Filter		25 mm throwaway										
Qty - size	mm	1 - 254 x 508			1 - 406 x 508			1 - 457 x 610		2 - 457 x 457		1 - 305 x 508 1 - 635 x 508
Operating weight	kg	50.0	50.9	55.0	66.8	76.8	87.7	99.5	104.1	116.8	121.4	146.8
Packaged weight	kg	54.5	55.5	59.5	71.4	81.4	92.3	105.0	109.5	122.3	126.8	153.6

PSC – Permanent split capacitor

* Based on Eurovent conditions: 27°C dry bulb, 19°C wet bulb entering air temperature and 30°C entering water temperature.

** Heating capacities based upon 20°C dry bulb, 15°C wet bulb entering air temperature and 20°C entering water temperature.

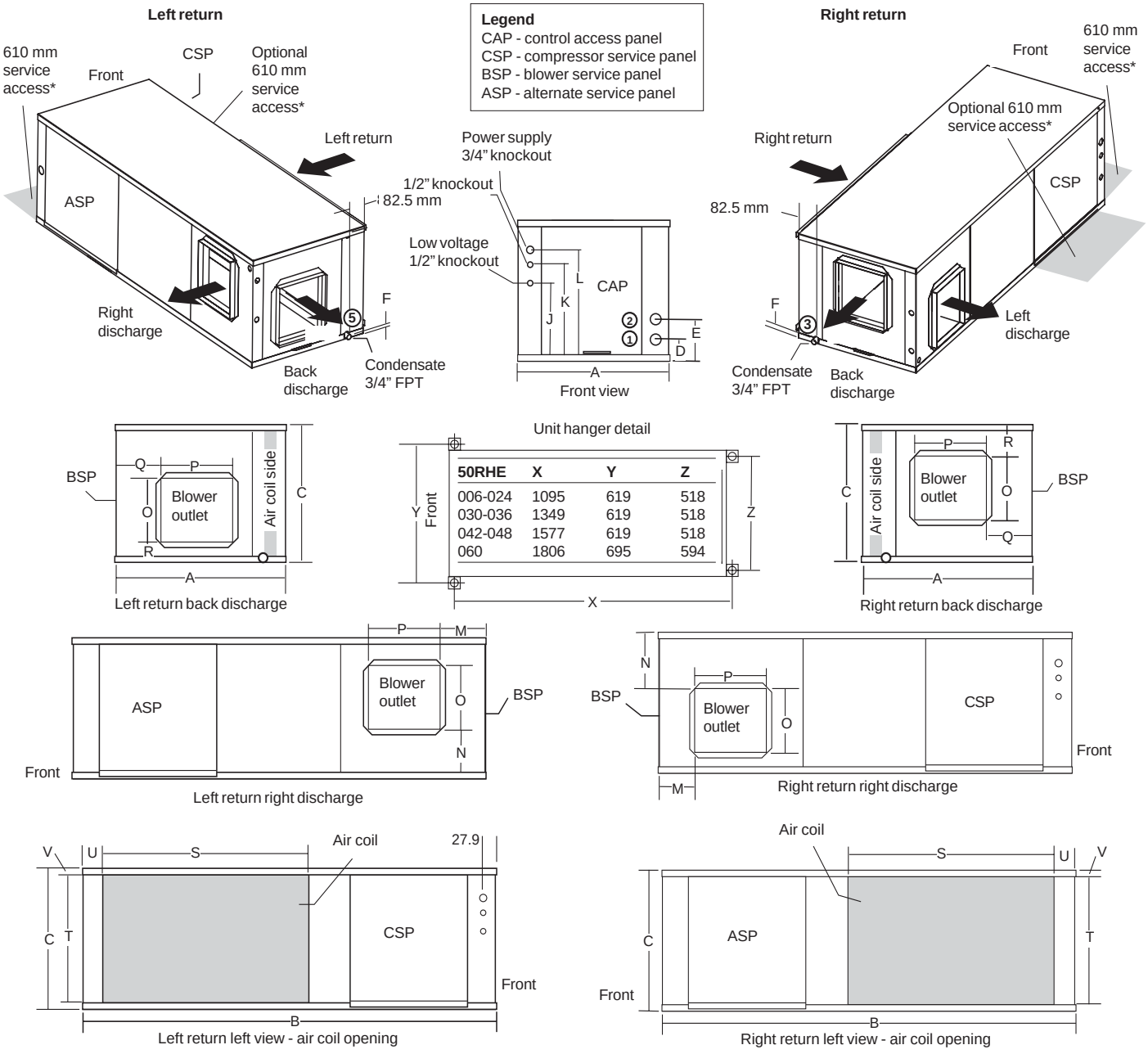
Notes:

1. All ratings based upon operation at lower voltage of dual voltage rated models.
2. All air flow is rated on high speed.
3. A water-to-air heat pump using water or brine circulating in a common piping loop functioning as a heat source/heat sink.
4. The temperature of the water or brine loop is usually mechanically controlled within a temperature range of 15.6°C to 35°C.

Fig. 1 - Dimensions

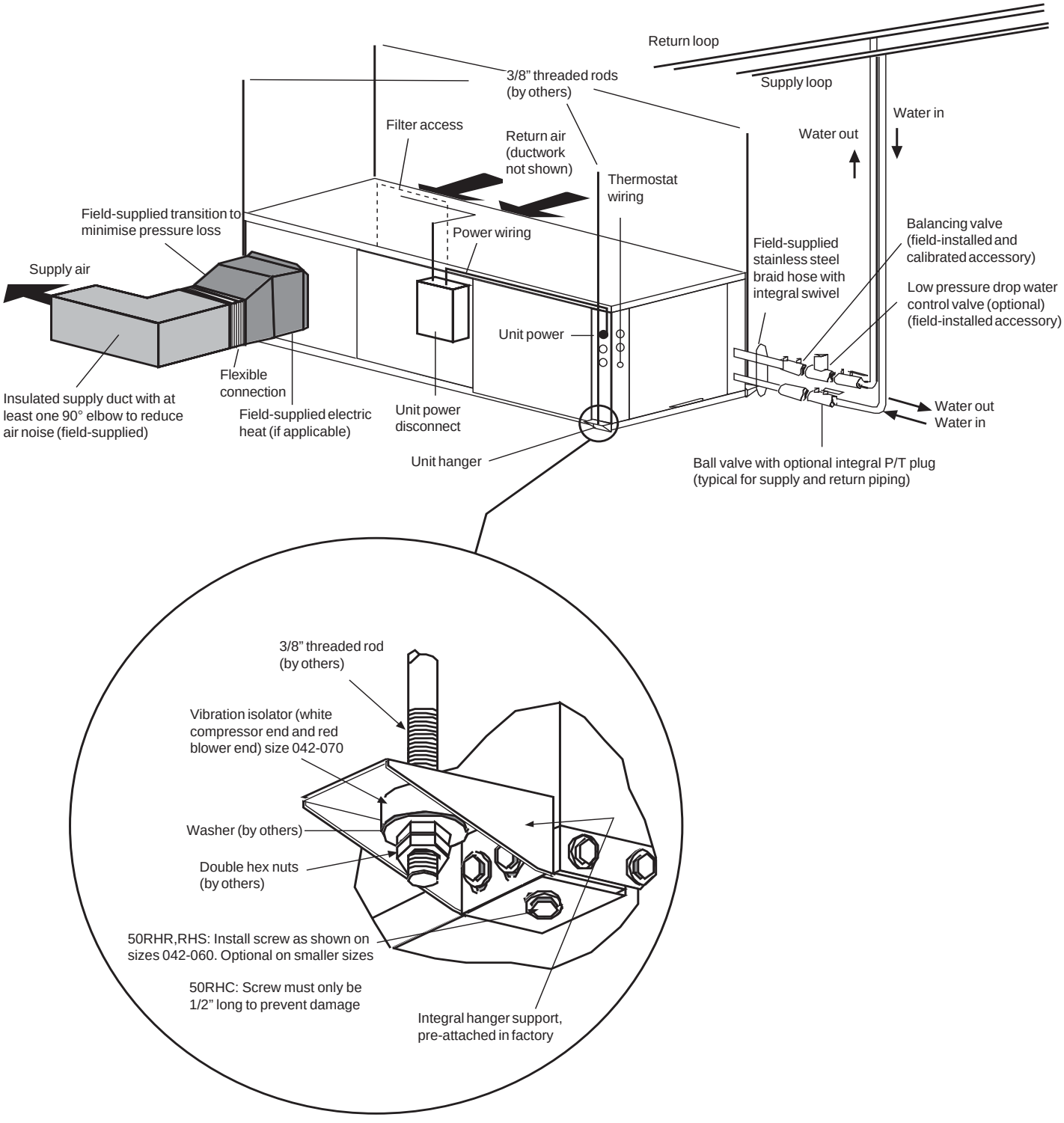
50RHE		006-012	015-024	030	036	042-048	060
Overall cabinet	mm						
A (width)		568	568	568	568	568	645
B (depth)		1095	1095	1351	1351	1580	1808
C (height)		287	439	490	490	490	541
Water connections	mm						
E (water out)		137	124	137	137	137	137
Electrical knockouts	mm						
J (1/2 conduit) low voltage		89	89	145	145	145	206
K (1/2 conduit) ext. pump		140	191	246	246	246	297
L (3/4 conduit) power supply		208	259	310	310	310	361
Discharge connection (duct flange installed ±2.5 mm)	mm						
M		147	127	127	74	74	147
N		102	142	173	97	97	127
O (supply height)		147	264	264	343	343	345
P (supply depth)		203	236	236	333	333	338
Q		147	127	127	74	74	147
R		38	38	53	48	48	74
Return connection (using return air opening)	mm						
S (return depth)		434	434	587	587	815	917
T (return height)		236	389	439	439	439	490

Notes:
1. Condensate is 3/4-in. FPT copper.
2. Horizontal unit shipped with filter bracket only. This bracket should be removed for return duct connection.
3. Hanger kit is factory-installed. Isolation grommets are provided.
4. Right and left orientation is determined by looking at water connection side (front).



* Shaded areas are recommended service areas, not required.

Fig. 2 - Typical installation - 50RHE units


Return loop
3/8" threaded rods (by others)
Supply loop
Water in
Water out
Filter access
Return air (ductwork not shown)
Thermostat wiring
Field-supplied transition to minimise pressure loss
Power wiring
Balancing valve (field-installed and calibrated accessory)
Field-supplied stainless steel braid hose with integral swivel
Supply air
Low pressure drop water control valve (optional) (field-installed accessory)
Unit power
Flexible connection
Insulated supply duct with at least one 90° elbow to reduce air noise (field-supplied)
Field-supplied electric heat (if applicable)
Unit power disconnect
Water out
Water in
Unit hanger
Ball valve with optional integral P/T plug (typical for supply and return piping)
3/8" threaded rod (by others)
Vibration isolator (white compressor end and red blower end) size 042-070
Washer (by others)
Double hex nuts (by others)
50RHR,RHS: Install screw as shown on sizes 042-060. Optional on smaller sizes
50RHC: Screw must only be 1/2" long to prevent damage
Integral hanger support, pre-attached in factory

Unit hanger isolation detail

3.3 - Unit location

The following guidelines should be considered when choosing a location for a water-source heat pump unit:

- Units are for indoor use only.
- Locate in areas where ambient temperatures are between 4.4°C and 37.8°C and relative humidity is no greater than 75%.
- Provide sufficient space for water, electrical and duct connections.
- Locate unit in an area that allows easy access and removal of filter and access panels.
- Allow enough space for service personnel to perform maintenance.
- Return air must be able to freely enter the space if unit needs to be installed in a confined area such as a closet.

NOTE: Correct placement of the horizontal unit can play an important part in minimising sound problems. Since ductwork is normally applied to these units, the unit can be placed so that the principal sound emission is outside the occupied space in sound-critical applications. A fire damper may be required by the local code if a fire wall is penetrated.

3.3.1 - Field conversion of discharge air

The discharge air of the 50RHE horizontal units can be converted between side and back discharge in the field. The conversion process is the same for right and left return configurations (see Figs. 3 and 4).

NOTE: It is not possible to convert return air between left or right return models in the field due to refrigerant piping changes.

Preparation

The unit should be on the ground in a well-lit area for conversion. Hung units should be taken down to ground level before converting.

Side to back discharge conversion

1. Remove screws to free the top and discharge panels (see Fig. 3).
2. Remove the access panel and set aside.
3. Lift the discharge panel from side of unit and rotate it to back using care not to damage blower wiring.
4. Check blower wire routing and connections for excessive tension or contact with sheet metal edges. Re-route if necessary.
5. Check refrigerant tubing for contact with other components. Adjust if necessary.
6. Reinstall top panel using screws set aside in Step 1.

NOTE: Location for some screws at bottom of discharge panel may have to be changed.

7. Manually spin fan wheel to check for obstructions. Adjust for any obstruction found.
8. Replace access panel.

Back to side discharge conversion

Follow instructions above for side to back discharge conversion, noting the panels would be reversed.

Fig. 3 - Conversion left return, side discharge to back discharge

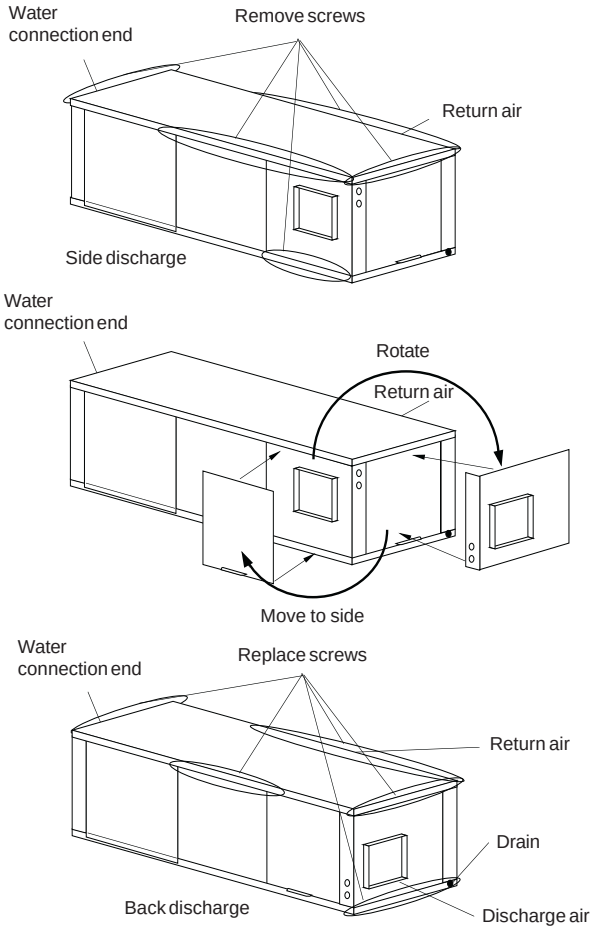
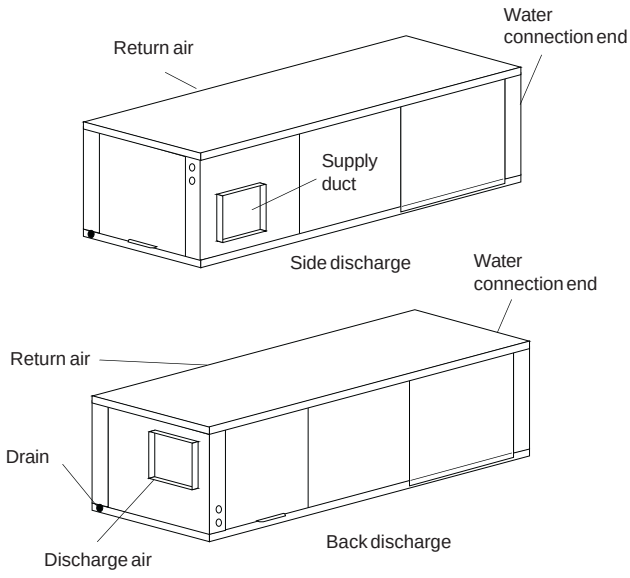


Fig. 4 - Conversion right return, side discharge to back discharge



3.4 - Mounting the unit

Horizontal units should be mounted using the factory-installed hangers. Proper attachment of hanging rods to building structure is critical for safety (see Figs. 2 and 5). Rod attachments must be able to support the weight of the unit. See Table 1 for unit operating weights.

3.5 - Duct system

Size the duct system to handle the design airflow quietly.

NOTE: Depending on the unit, the fan wheel may have a shipping support installed at the factory. This must be removed before operating unit.

3.5.1 - Sound attenuation

To eliminate the transfer of vibration to the duct system, a flexible connector is recommended for both discharge and return air duct connections on metal duct systems. The supply and return plenums should include internal duct liner of fibreglass or be made of duct board construction to maximise sound attenuation of the blower. Installing the water-source heat pump unit to un-insulated ductwork in an unconditioned space is not recommended since it will sweat and adversely affect the unit performance.

To reduce air noise, at least one 90° elbow could be included in the supply and return air ducts, provided system performance is not adversely impacted. The blower speed can also be changed in the field to reduce air noise or excessive airflow, provided system performance is not adversely impacted.

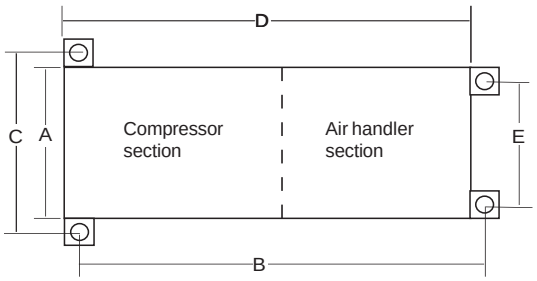
3.5.2 - Existing duct system

If the unit is connected to existing ductwork, consider the following:

- Verify that the existing ducts have the proper capacity to handle the unit airflow. If the ductwork is too small, install larger ductwork.
- Check existing ductwork for leaks and repair as necessary.

NOTE: Local codes may require ventilation air to enter the space for proper indoor air quality. Hard-duct ventilation may be required for the ventilating air supply. If hard ducted ventilation is not required, be sure that a proper air path is provided for ventilation air to unit to meet ventilation requirement of the space.

Fig. 5 - Horizontal hanger bracket (factory-installed)



50RHE	Dimensions, mm				
	A	B	C	D	E
006-024	568	1095	619	1095	516
030, 036	568	1349	619	1349	518
042, 048	568	1577	619	1577	518
060	645	1806	695	1806	594

3.6 - Condensate drain

Slope the unit toward the drain at a 6.5 mm per 300 mm pitch (see Fig. 6). If it is not possible to meet the required pitch, install a condensate pump at the unit to pump condensate to building drain.

Horizontal units are not internally trapped; therefore an external trap is necessary. Install each unit with its own individual trap and means to flush or blowout the condensate drain line. Do not install units with a common trap or vent. For typical condensate connections see Fig. 7.

NOTE: Never use a pipe size smaller than the connection.

3.6.1 - Venting

Install a vent in the condensate line of any application that may allow dirt or air to collect in the line. Consider the following:

- Always install a vent where an application requires a long horizontal run.
- Always install a vent where large units are working against higher external static pressure and to allow proper drainage for multiple units connected to the same condensate main.
- Be sure to support the line where anticipated sagging from the condensate or when “double trapping” may occur.
- If condensate pump is present on unit, be sure drain connections have a check valve to prevent back flow of condensate into other units.

Fig. 6 - Horizontal unit pitch

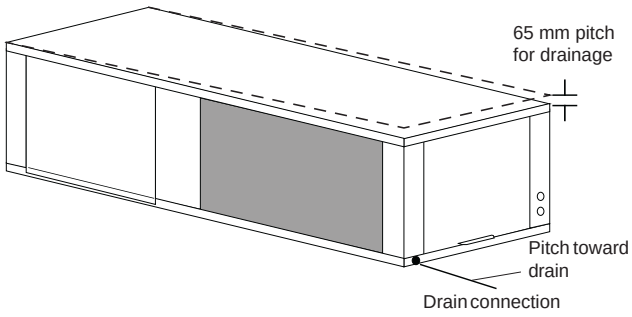
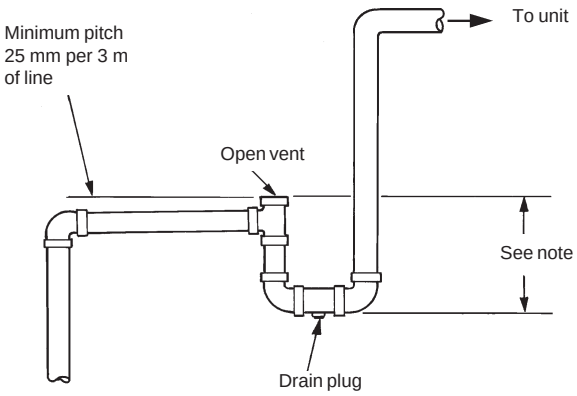


Fig. 7 - Trap condensate drain



Note: Trap should be deep enough to offset maximum unit static difference. A 102 mm trap is recommended.

3.7 - Piping connections

Depending on the application, there are three types of water-source heat pump piping systems to choose from: water loop, ground-water and ground-loop. Refer to piping section of Carrier System Design Manual for additional information.

All water-source heat pump units use low temperature soldered female pipe thread fittings for water connections to prevent annealing and out-of-round leak problems which are typically associated with high temperature brazed connections. Refer to Table 1 for connection sizes. When making piping connections, consider the following:

- Use a backup wrench when making screw connections to unit to prevent internal damage to piping.
- Insulation may be required on piping to avoid condensation in the case where fluid in loop piping operates at temperatures below dew point of adjacent air.
- Piping systems that contain steel pipes or fittings may be subject to galvanic corrosion. Dielectric fittings should be used to isolate the steel parts of the system to avoid galvanic corrosion.

3.7.1 - Water loop applications

Water loop applications usually include a number of units plumbed to a common piping system. Maintenance to any of these units can introduce air into the piping system. Therefore, air elimination equipment comprises a major portion of the mechanical room plumbing.

The flow rate is usually set between 0.040 and 0.054 l/s per kW of cooling capacity. For proper maintenance and servicing, pressure-temperature (P/T) ports are necessary for temperature and flow verification.

In addition to complying with any applicable codes, consider the following for system piping:

- Piping systems using water temperatures below 10°C require 13 mm closed cell insulation on all piping surfaces to eliminate condensation.
- Avoid all plastic-to-metal threaded fittings due to the potential to leak. Use a flange fitted substitute.
- Teflon tape thread sealant is recommended to minimise internal fouling of the heat exchanger.
- Use backup wrench. Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Flush the piping system prior to operation to remove dirt and foreign materials from the system.

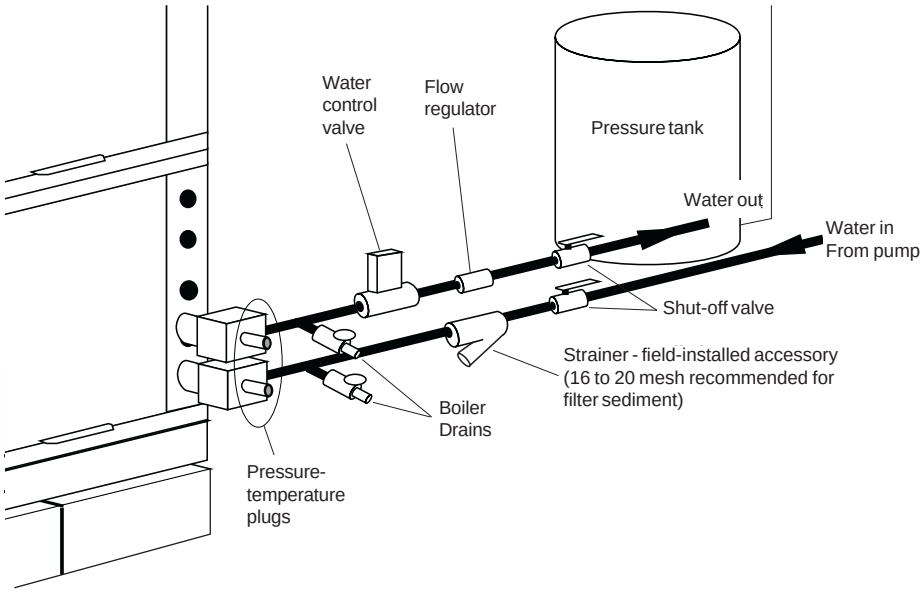
3.7.2 - Ground-water applications

Typical ground-water piping is shown in Fig. 8. In addition to complying with any applicable codes, consider the following for system piping:

- Install shut-off valves for servicing.
- Install pressure-temperature plugs to measure flow and temperature.
- Connect boiler drains and other valves using a “T” connector to allow acid flushing for the heat exchanger.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Use PVC SCH80 or copper piping material.

NOTE: PVC SCH40 should not be used due to system high pressure and temperature extremes.

Fig. 8 - Typical ground-water piping installation



Water supply and quantity
Check water supply. Water supply should be plentiful and of good quality. See Table 2 for water quality guidelines.

IMPORTANT: Failure to comply with the above required water quality and quantity limitations and the closed-system application design requirements may cause damage to the tube-in-tube heat exchanger that is not the responsibility of the manufacturer.

In all applications, the quality of the water circulated through the heat exchanger must fall within the ranges listed in the water quality guidelines table. Consult a local water treatment firm, independent testing facility or local water authority for specific recommendations to maintain water quality within the published limits.

3.7.3 - Ground-loop applications
Temperatures between -4 to 43°C and a liquid flow rate of 0.040 to 0.054 l/s per kW of cooling capacity is recommended. In addition to complying with any applicable codes, consider the following for system piping:

- Limit piping materials to only polyethylene fusion in the buried sections of the loop.
- Do not use galvanized or steel fittings at any time due to corrosion.
- Avoid all plastic to metal threaded fittings due to the potential to leak. Use a flange fitted substitute.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Use pressure-temperature (P/T) plugs to measure flow of pressure drop.

3.8 - Electrical wiring

WARNING: To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

CAUTION: Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

All field-installed wiring, including the electrical ground, MUST comply with applicable local, national and regional codes.

Refer to unit wiring diagrams Figs. 9-12 for a schematic of the field connections, which must be made by the installing (or electrical) contractor. Refer to electrical data for fuse sizes.

Consult the unit wiring diagram located on the inside of the compressor access panel to ensure proper electrical hookup. The installing (or electrical) contractor must make the field connections when using field-supplied disconnect.

Operating voltage must be the same voltage and phase as shown in electrical data shown in Table 3.

Make all final electrical connections with a length of flexible conduit to minimise vibration and sound transmission to the building.

Table 2 - Water quality guidelines

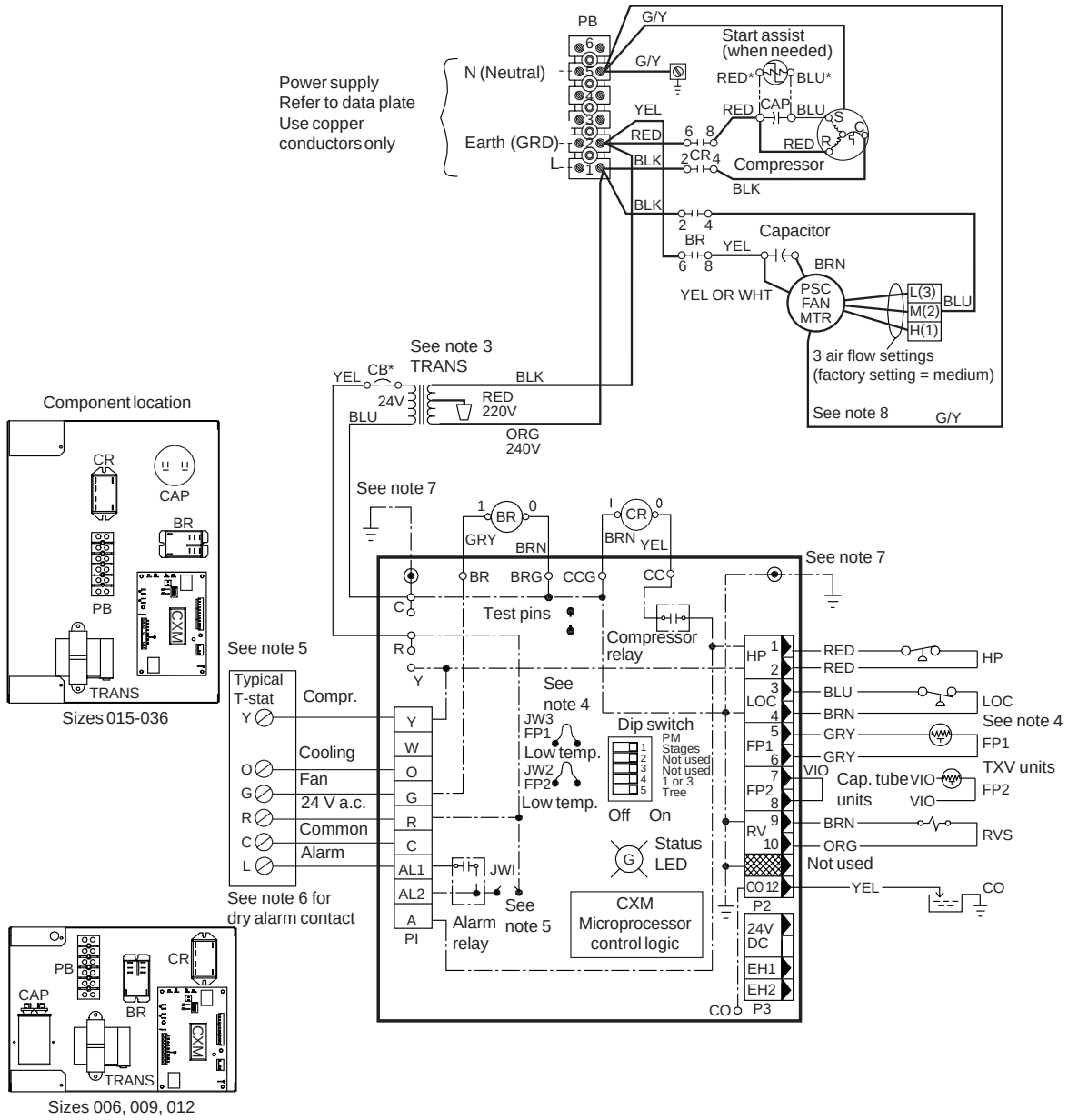
Condition	Acceptable level		
pH	7 to 9 range for copper. Cupronickel may be used in the 5 to 9 range.		
Total hardness	Calcium and magnesium carbonate should not exceed 350 ppm.		
Iron oxides	Less than 1 ppm.		
Iron bacteria	No level allowable.		
Corrosion*		**Max. allowable level**	**Coaxial metal**
	Ammonia, ammonium hydroxide	0.5 ppm	Cu
	ammonium chloride, ammonium nitrate	0.5 ppm	Cu
	ammonium sulphate	0.5 ppm	Cu
	chlorine/chlorides	0.5 ppm	CuNi
	hydrogen sulphide**	None Allowable	-
Brackish	Use cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

* If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.

** Sulphides in the water quickly oxidise when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilisation with a few drops of one molar zinc acetate solution, allowing accurate sulphide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water contains a pH of 7.0.

Note: Hardness in mg/l is equivalent to ppm.

Fig. 9 - Typical Aquazone Complete C control wiring (single-phase unit)



Legend

AL	Alarm relay contacts
BR	Blower relay
CAP	Compressor capacitor
CB	Circuit breaker
CC	Compressor contactor
CO	Sensor, condensate overflow
FP1	Sensor, water coil freeze protection
FP2	Sensor, air coil freeze protection
GND	Ground
HP	High pressure switch
JW	Clippable field selection jumper
LOC	Loss of charge pressure switch
P1	Field wiring terminal block
PB	Power block

PM	Performance Monitor
PSC	Permanent split capacitor
RVS	Reversing valve solenoid
TRANS	Transformer optional wiring
▬▬▬	Field line voltage wiring
- - - -	Field low voltage wiring
—·—	Printed circuit trace
—··—	Optional wiring
	Relay/contactor coil
	Thermistor

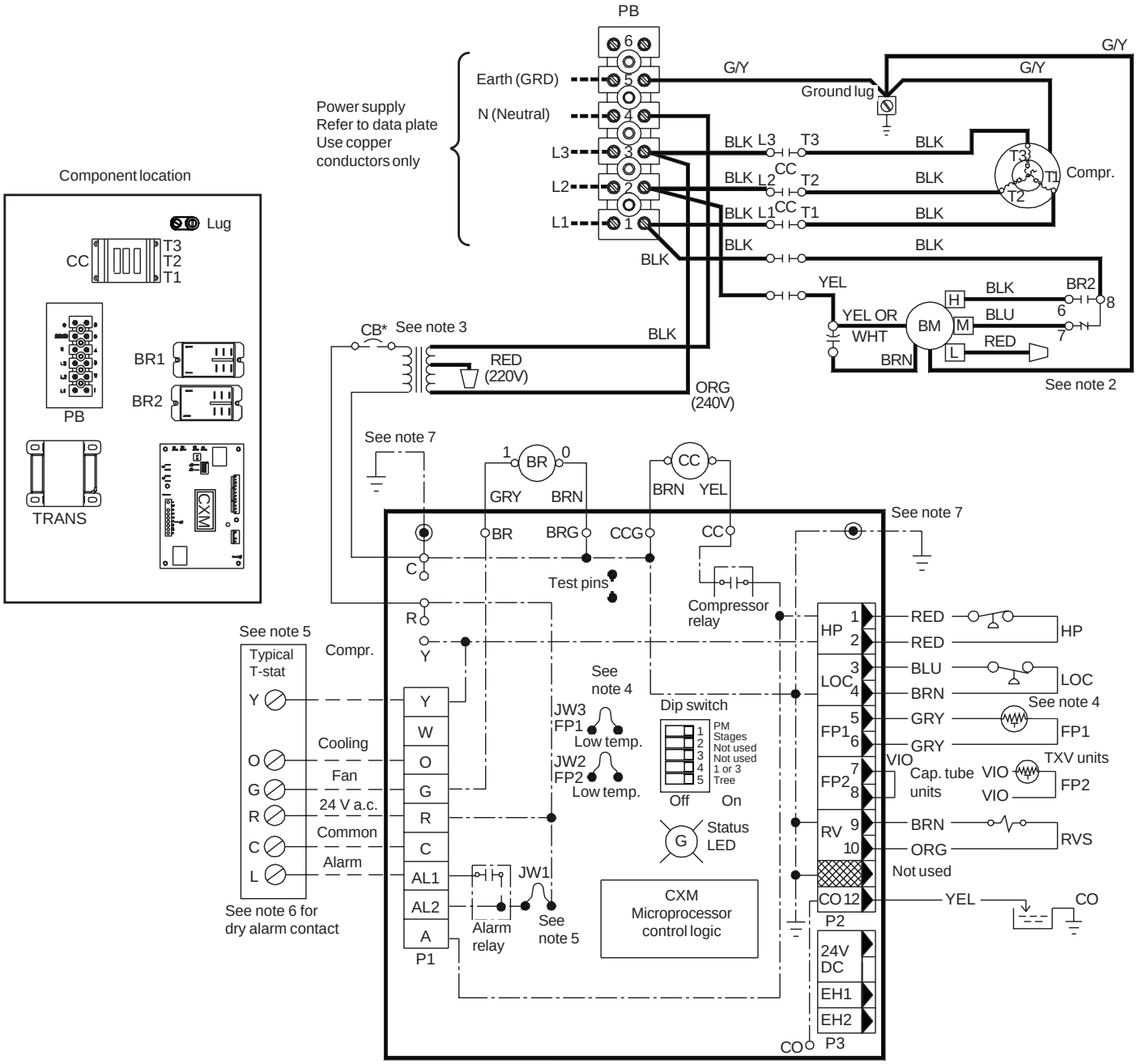
	Condensate pan
	Circuit breaker
	Relay contacts - NC
	Solenoid coil
	Relay contacts - NO
	Switch temperature
	Switch low pressure
	Ground
	Wire nut

* Optional wiring

Notes:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 240 V (ORG) lead for 240-1-50 units, switch RED and ORG leads to PB(1) and insulate ORG lead.
4. FP1 thermistor provides freeze protection for water. When using anti-freeze solutions, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit.
6. 24-V alarm signal shown. For dry alarm contact, cut JW1 jumper, and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via microprocessor board stand-offs and screws to control box. (Ground available from top two stand-offs as shown.)
8. Fan motors factory-wired for medium speed. For high or low speed remove BLU wire from fan motor speed tap 'M' and connect to 'H' for high or 'L' for low.

Fig. 10 - Typical Aquazone Complete C control wiring (three-phase unit)



Legend

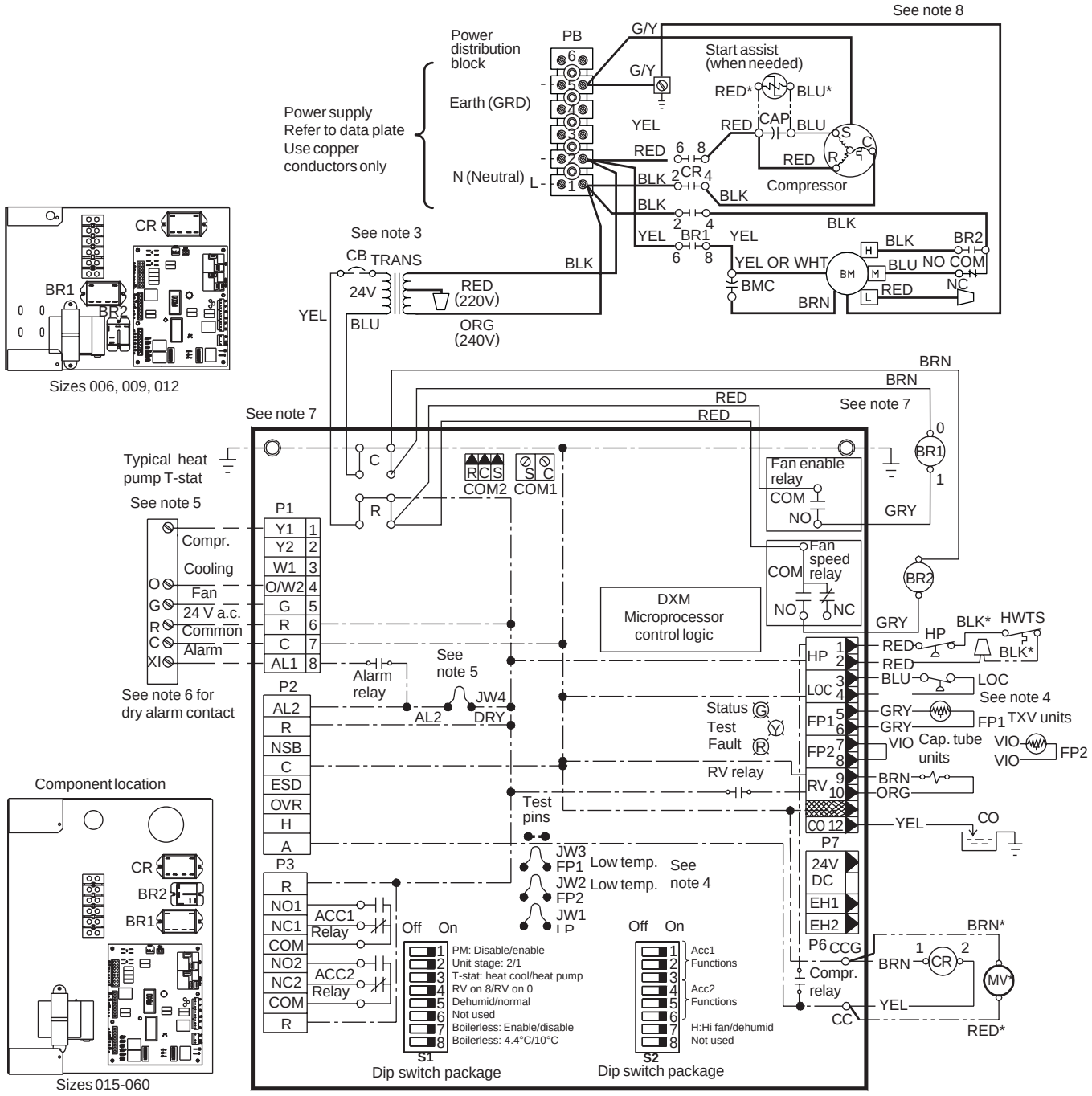
AL	Alarm relay contacts
BR	Blower relay
CAP	Compressor capacitor
CB	Circuit breaker
CC	Compressor contactor
CO	Sensor, condensate overflow
COMP	Compressor
FP1	Sensor, water coil freeze protection
FP2	Sensor, air coil freeze protection
GND	Ground
HP	High pressure switch
JW	Clippable field selection jumper
LOC	Loss of charge pressure switch
P1	Field wiring terminal block
PB	Power block
PM	Performance Monitor
PSC	Permanent split capacitor
RVS	Reversing valve solenoid
TRANS	Transformer optional wiring
	Field line voltage wiring
	Field low voltage wiring
	Printed circuit trace
	Optional wiring
	Relay/contactor coil
	Thermistor
	Condensate pan
	Circuit breaker
	Relay contacts - NC
	Solenoid coil
	Relay contacts - NO
	Switch temperature
	Switch low pressure
	Ground
	Wire nut
	Splice cap

* Optional wiring

Notes:

1. Compressor and blower motor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 240 V (ORG) lead for 240-1-50 units, switch RED and ORG leads to PB(3) and insulate ORG lead.
4. FP1 thermistor provides freeze protection for water. When using anti-freeze solutions, cut JW3 jumper.
5. Typical heat pump thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit.
6. 24-V alarm signal shown. For dry alarm contact, cut JW1 jumper, and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via microprocessor board stand-offs and screws to control box. (Ground available from top two stand-offs as shown.)
8. Fan motors factory-wired for medium speed. For high or low speed remove BLU wire from fan motor speed tap 'M' and connect to 'H' for high or 'L' for low.

Fig. 11 - Typical Aquazone Deluxe D control wiring (single-phase unit)



Legend

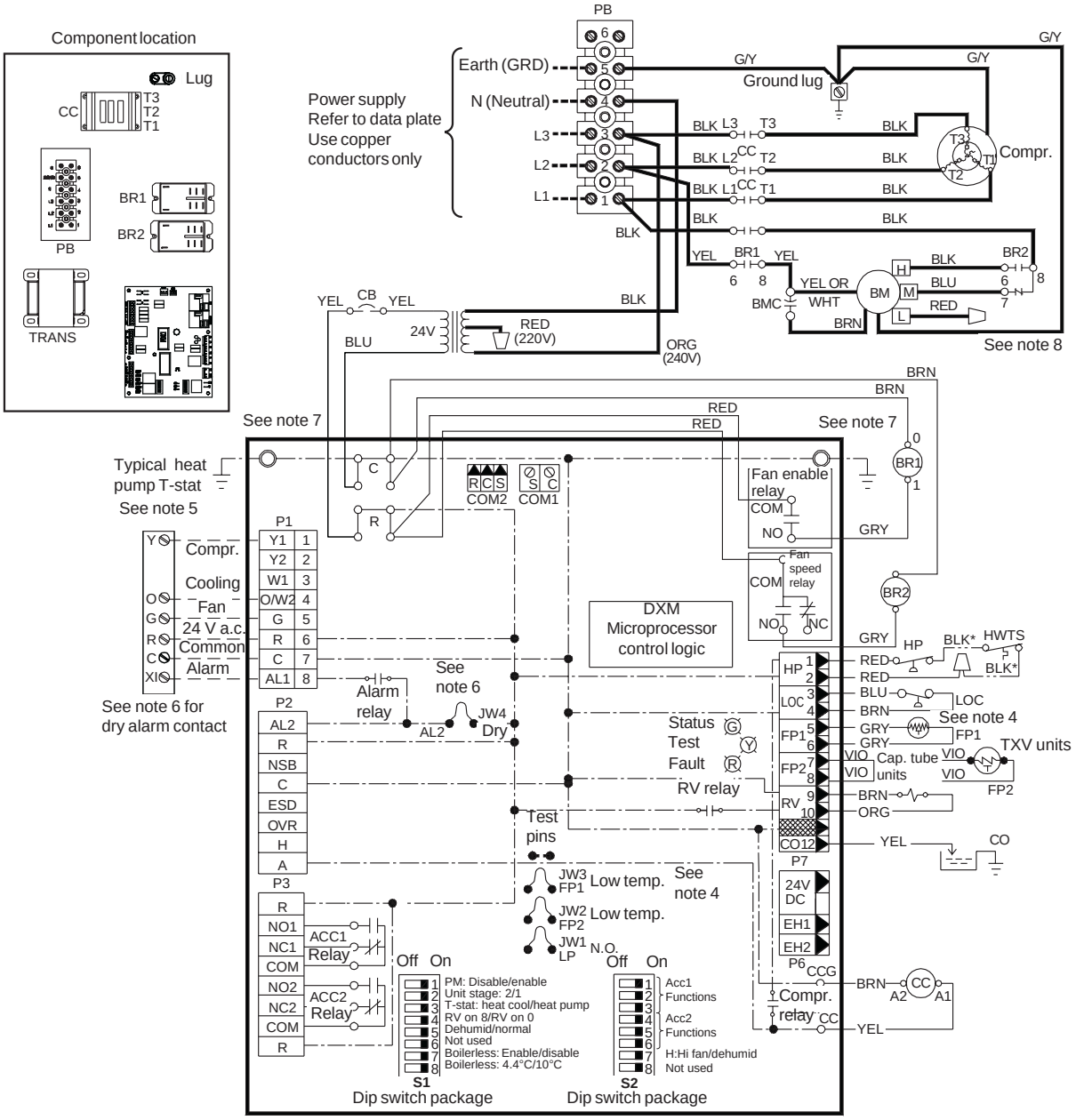
AL	Alarm relay contacts
BM	Blower motor
BMC	Blower motor capacitor
BR	Blower relay
CAP	Compressor capacitor
CB	Circuit breaker
CO	Sensor, condensate overflow
FP1	Sensor, water coil freeze protection
FP2	Sensor, air coil freeze protection
GND	Ground
HP	High pressure switch
HWTS	High (leaving) water temperature switch
JW	Clippable field selection jumper
LOC	Loss of charge pressure switch
MV	Motorised valve
P1	Field wiring terminal block
PB	Power block
PM	Performance Monitor
PSC	Permanent split capacitor
RVS	Reversing valve solenoid
TRANS	Transformer optional wiring
	Field line voltage wiring
	Field low voltage wiring
	Printed circuit trace
	Optional wiring
	Relay/contactor coil
	Thermistor
	Condensate pan
	LED
	Solenoid coil
	Relay contacts - NO
	Temperature switch
	Switch - loss of charge
	Ground
	Wire nut

* Optional wiring

Notes:

1. Compressor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Transformer is wired to 240 V (ORG) lead for 240-1-50 units, switch RED and ORG leads to PB(1) and insulate ORG lead for 220-1-50.
4. FP1 thermistor provides freeze protection for water. When using anti-freeze solutions, cut JW3 jumper.
5. Check installation wiring information for specific thermostat hook-up. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be 'Class 1' and voltage rating equal to or greater than unit supply voltage.
6. 24-V alarm signal shown. For dry alarm contact, cut JW4 jumper, and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via microprocessor board stand-offs and screws to control box. (Ground available from top two stand-offs as shown.)
8. Blower motor is factory-wired for medium and high speeds. For any other combination of speeds, at the motor attach black wire to the higher of the two desired speed taps, and the blue wire to the lower of the two desired speed taps.

Fig. 12 - Typical Aquazone Deluxe D control wiring (three-phase unit)



Legend

AL	Alarm relay contacts
BM	Blower motor
BMC	Blower motor capacitor
BR	Blower relay
CAP	Compressor capacitor
CB	Circuit breaker
CO	Sensor, condensate overflow
FP1	Sensor, water coil freeze protection
FP2	Sensor, air coil freeze protection
GND	Ground
HP	High pressure switch
HWTS	High (leaving) water temperature switch
JW	Clippable field selection jumper
LOC	Loss of charge pressure switch
MV	Motorised valve
P1	Field wiring terminal block
PB	Power block
PM	Performance Monitor
PSC	Permanent split capacitor
RVS	Reversing valve solenoid
TRANS	Transformer optional wiring
▬▬▬	Field line voltage wiring
- - - -	Field low voltage wiring
▬ · ▬	Printed circuit trace
▬ ·· ▬	Optional wiring
◯	Relay/contactor coil
◯	Thermistor
⎓	Condensate pan
	Circuit breaker
G	LED
	Capacitor
	Solenoid coil
	Relay contacts - NO
	Temperature switch
	Switch - loss of charge
⏚	Ground
	Wire nut

* Optional wiring

Notes:

1. Compressor thermally protected internally.
2. All wiring to the unit must comply with local codes.
3. Neutral of 380/415-3-50 is required. Transformer is wired to 240 V (ORG) lead for 415-3-50. For 380-3-50 switch ORG and (RED) leads at PB(2) and insulate ORG lead. Transformer uses separate circuit breaker.
4. FP1 thermistor provides freeze protection for water. When using anti-freeze solutions, cut JW3 jumper.
5. Check installation wiring inforation for specific thermostat hook-up. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be 'Class 1' and voltage rating equal to or greater than unit supply voltage.
6. 24-V alarm signal shown. For dry alarm contact, cut JW4 jumper, and dry contact will be available between AL1 and AL2.
7. Transformer secondary ground via microprocessor board stand-offs and screws to control box. (Ground available from top two stand-offs as shown.)
8. Blower motor is factory-wired for medium and high speeds. For any other combination of speeds, at the motor attach black wire to the higher of the two desired speed taps, and the blue wire to the lower of the two desired speed taps.
9. Blower motor is factory-wired for high and low speeds. No other combination of speeds is available.

Table 3 - Electrical data

50RHE	Power supply V-ph-Hz	Voltage min./max. V	Compressor RLA	Compressor LRA	Fan motor FLA	Total unit FLA	Min. circuit current A	Max. fuse/HACR A
006	220/240-1-50	197/254	2.3	15.0	0.4	2.7	3.2	15
009	220/240-1-50	197/254	2.7	18.8	0.7	3.7	4.5	15
012	220/240-1-50	197/254	3.9	22.2	0.7	4.5	5.6	15
015	220/240-1-50	197/254	4.2	27.0	0.9	5.9	7.1	15
019	220/240-1-50	197/254	6.8	45.0	0.9	8.6	10.5	15
024	220/240-1-50	197/254	8.2	51.0	1.6	10.4	12.6	20
030	220/240-1-50	197/254	9.1	54.0	1.7	11.2	13.6	20
	380-415-3-50	342/462	3.3	25.0	1.0	4.3	5.2	15
036	220/240-1-50	197/254	11.5	83.0	2.7	17.2	20.8	35
	380-415-3-50	342/462	4.2	32.0	1.7	5.9	6.0	15
042	380-415-3-50	342/462	5.5	34.5	1.7	6.0	7.1	15
048	380-415-3-50	342/462	5.9	42.0	1.8	7.5	8.9	15
060	380-415-3-50	342/462	8.2	61.8	2.5	9.9	11.8	15

Legend
FLA - Full load amperes
HACR - Heating, air conditioning and refrigeration
LRA - Locked rotor amperes
RLA - Rated load amperes

3.8.1 - Power connection

Make line voltage connection by connecting the incoming line voltage wires to the L side of the CC terminal as shown in Fig. 13. See Table 3 for correct wire and maximum overcurrent protection sizing.

3.8.2 - Supply voltage

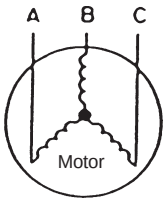
Operating voltage to unit must be within voltage range indicated on unit nameplate.

On 3-phase units, voltages under load between phases must be balanced within 2%. Use the following formula to determine the percentage voltage imbalance:

$$\% \text{ voltage imbalance} = 100 \times \frac{\text{max. voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.
AB = 452 Volts
BC = 464 Volts
AC = 455 Volts

$$\text{Average voltage} = \frac{452 + 464 + 455}{3} = \frac{1371}{3} = 457$$



Determine maximum deviation from average voltage:
(AB) 457 - 452 = 5 V
(BC) 464 - 457 = 7 V
(AC) 457 - 455 = 2 V
Maximum deviation is 7 V.

Determine percent voltage imbalance.

$$\% \text{ voltage imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

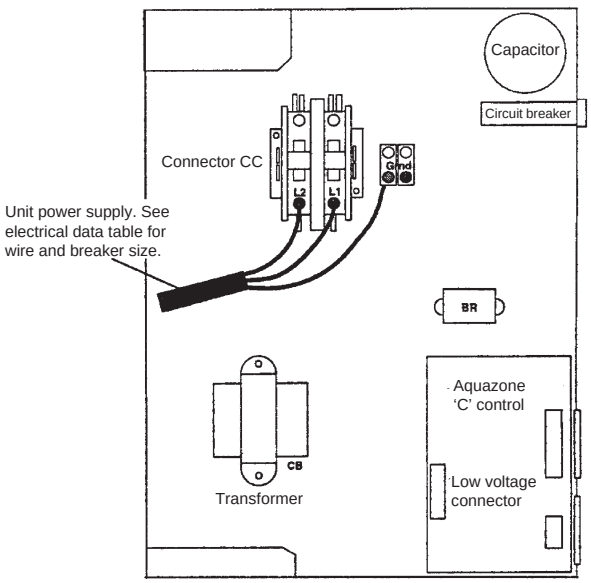
Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

NOTE: If more than 2% voltage imbalance is present, contact local electric utility.

3.8.3 - 220-Volt operation

All 220-240-Volt units are factory wired for 208 Volts. The transformers may be switched to 220-Volt operation by switching the red (220-Volt) wire with the orange (240-Volt) wire at the TB1-1 terminal for single-phase and TB1-3 for 3-phase.

Fig. 13 - 50RHE typical single-phase line voltage power connection



3.8.4 - PSC (permanent split capacitor) blower speed selection

All water-source heat pumps are factory-set to deliver rated air flow at nominal static (37 Pa) on medium speed. Where higher static is needed, high speed can be utilised (100 to 125 Pa). Low speed will deliver approximately 85% of rated air flow (25 Pa). The PSC blower fan speed can be changed on all units by swapping wires connected to the relay contacts that control the fan (see Table 4 and Fig. 14).

NOTE: Available air flow for all units is shown in Table 4.

Fig. 14 - 50RHE blower speed selection

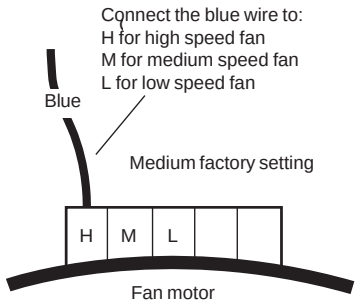


Table 4 - Fan performance

50RHE blower performance

50RHE	Nominal air flow l/s	Minimum air flow l/s	Fan speed	Air flow, l/s External static pressure, Pa 0	25	50	75	100	125
006	81	61	High	133	123	112	89	78	-
			Medium	110	99	87	68	-	-
			Low	98	90	75	60	-	-
009	113	85	High	165	151	142	118	99	-
			Medium	160	146	127	113	94	-
			Low	151	137	123	109	90	-
012	140	104	High	170	165	151	137	123	109
			Medium	165	151	142	127	118	-
			Low	146	137	127	118	104	-
015	212	160	High	345	316	288	250	198	-
			Medium	321	302	274	241	189	-
			Low	293	278	255	222	179	-
019	264	198	High	326	311	283	250	203	-
			Medium	302	288	260	227	189	-
			Low	293	269	245	217	179	-
024	307	231	High	396	368	335	302	260	-
			Medium	387	359	326	297	255	-
			Low	368	340	311	278	231	-
030	349	264	High	529	496	463	425	378	330
			Medium	510	477	448	415	368	326
			Low	458	439	406	378	340	297
036	437	326	High	614	576	579	463	415	373
			Medium	580	543	488	434	392	349
			Low	505	472	429	387	349	-
042	530	396	High	743	691	629	566	501	435
			Medium	637	593	539	485	429	-
			Low	498	463	421	-	-	-
048	630	472	High	793	738	672	604	535	464
			Medium	777	723	658	592	524	455
			Low	762	709	645	580	514	446
High static									
048	630	472	High	-	-	-	757	668	552
			Medium	-	-	787	710	623	529
			Low	-	797	748	690	612	516
060	790	595	High	896	866	833	796	755	710
			Medium	818	803	779	747	707	658
			Low	748	731	709	683	653	618

Legend

Shaded areas are below minimum air flow. This data is provided for troubleshooting information only.

Notes:

1. Units factory-shipped on medium speed. Other speeds require field selection.
2. For dual voltage units, air flow is rated at lowest voltage.
3. Performance data shown is based on wet coil and clean air filter.

3.9 - Low voltage wiring (see Fig. 15)

3.9.1 - Thermostat connections
The thermostat should be wired directly to the Aquazone control board (see Figs. 9-12).

3.9.2 - Water freeze protection
The Aquazone control allows the field selection of source fluid freeze protection points through jumpers. The factory setting of jumper JW3 (FP1) is set for water at -1.1°C. In earth loop applications, jumper JW3 should be clipped to change the setting to -10.6°C when using anti-freeze in colder earth loop applications (see Fig. 16).

3.9.3 - Air coil freeze protection
The air coil freeze protection jumper JW2 (FP2) is factory-set for -1.1°C and should not need adjusting.

3.9.4 - Accessory connections
Terminal A on the control is provided to control accessory devices such as water valves, electronic air cleaners, humidifiers, etc. This signal operates with the compressor terminal (see Fig. 17). Refer to the specific unit wiring schematic for details.

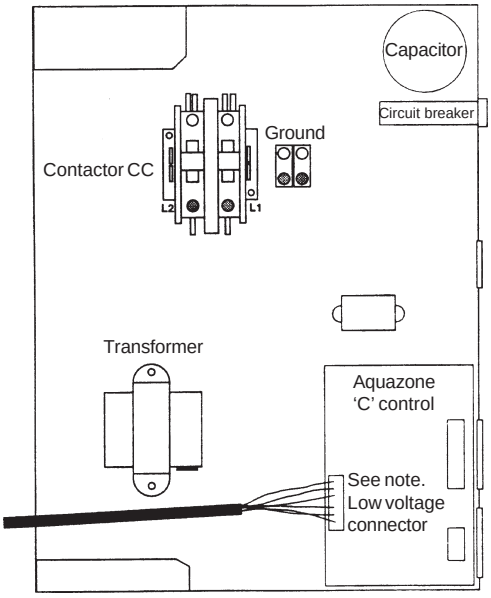
NOTE: The A terminal should only be used with 24-Volt signals - not line voltage signals.

3.9.5 - Water solenoid valves
Water solenoid valves may be used on primary/secondary pump and ground water installations. A typical well water control valve wiring approach, which can limit waste water in a lockout condition, is shown in Fig. 17. A slow-closing valve may be required to prevent water hammer. When using a slow-closing valve, consider special wiring conditions. The valve takes approximately 60 seconds to open (very little water will flow before 45 seconds) and it activates the compressor only after the valve is completely opened by closing its end switch. When wired as shown, the valve will have the following operating characteristics:

1. Remain open during a lockout
2. Draw approximately 25 to 35 VA through the "Y" signal of the thermostat.

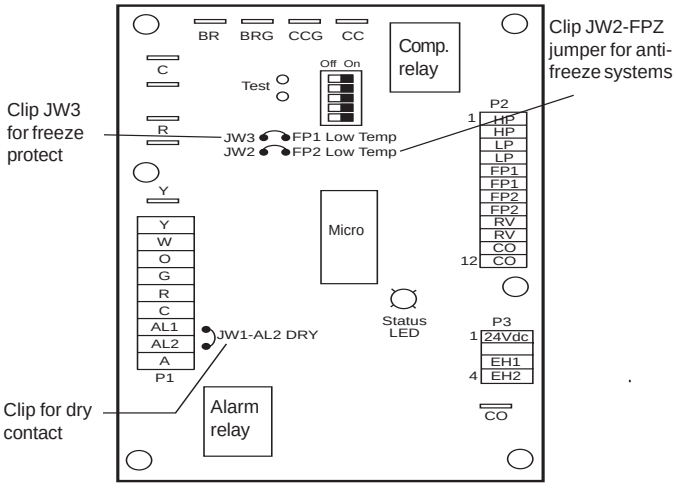
IMPORTANT: Connecting a water solenoid valve can overheat the anticipators of electromechanical thermostats. Only use relay based electronic thermostats.

Fig. 15 - Low voltage field wiring



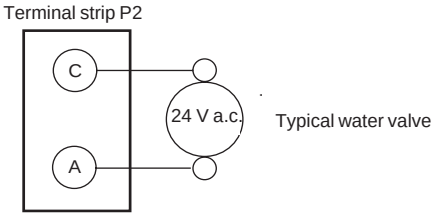
Note: Low voltage connector may be removed for easy installation.

Fig. 16 - Typical Aquazone control board jumper locations



Aquazone control (C control shown)

Fig. 17 - Typical D control accessory wiring



4 - PRE-START-UP

4.1 - System checkout

When the installation is complete, follow the system checkout procedure outlined below before starting up the system. Be sure:

1. Voltage is within the utilisation range specifications of the unit compressor and fan motor and voltage is balanced for 3-phase units.
2. Fuses, breakers and wire are correct size.
3. Low voltage wiring is complete.
4. Piping and system flushing is complete.
5. Air is purged from closed loop system.
6. System is balanced as required. Monitor if necessary.
7. Isolation valves are open.
8. Water control valves or loop pumps are wired.
9. Condensate line is open and correctly pitched.
10. Transformer switched to lower voltage tap if necessary.
11. Blower rotates freely - shipping support is removed.
12. Blower speed is on correct setting.
13. Air filter is clean and in position.
14. Service/access panels are in place.
15. Return air temperature is between 4.4 to 26.7°C heating and 10 to 43.3°C cooling.
16. Air coil is clean.
17. Control field selected settings are correct.

4.1.1 - Air coil

To obtain maximum performance, clean the air coil before starting the unit. A 10% solution of dishwashing detergent and water is recommended for both sides of the coil. Rinse thoroughly with water.

5 - FIELD SELECTABLE INPUTS

Jumpers and DIP (dual in-line package) switches on the control board are used to customise unit operation and can be configured in the field.

IMPORTANT: Jumpers and DIP switches should only be clipped when power to control board has been turned off.

5.1 - Complete C control jumper settings (see Figs. 9 and 10)

Water coil freeze protection (FP1) limit setting - Select jumper 3 (JW3-FP1 low temp.) to choose FP1 limit of -12.2°C or -1.1°C. To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

Air coil freeze protection (FP2) limit setting - Select jumper 2 (JW2-FP2 low temp.) to choose FP2 limit of -12.2°C or -1.1°C. To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

Alarm relay setting - Select jumper 1 (JW1-AL2 dry) for connecting alarm relay terminal (AL2) to 24 VAC (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

5.2 - Complete C control DIP switches

The Complete C control has 1 DIP switch block with five switches (see Figs. 9 and 10).

Performance Monitor (PM) - DIP switch 1 will enable or disable this feature. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.

Stage 2 - DIP switch 2 will enable or disable compressor delay. Set DIP switch to OFF for stage 2 in which the compressor will have a 3-second delay before energizing.

Switches 3 and 4 - Not used.

1 or 3 tries - DIP switch 5 provides selection of whether there are 1 or 3 tries for FP1 and FP2. This only applies to FP1 and FP2, and not to any other faults. Set DIP switch 5 to ON for 1 try or to OFF for 3 tries.

NOTE: The alarm relay will not cycle during Test mode if switch is set to OFF, stage 2.

5.3 - Deluxe D control jumper settings (see Figs. 11 and 12)

Water coil freeze protection (FP1) limit setting - Select jumper 3 (JW3-FP1 low temp.) to choose FP1 limit of -12.2°C or -1.1°C. To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

Air coil freeze protection (FP2) limit setting - Select jumper 2 (JW2-FP2 low temp.) to choose FP2 limit of -12.2°C or -1.1°C. To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

Alarm relay setting - Select jumper 4 (JW4-AL2 dry) for connecting alarm relay terminal (AL2) to 24 VAC (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

Low pressure setting - The Deluxe D control can be configured for low pressure setting (LP). Select jumper 1 (JW1-LP norm. open) for choosing between low pressure input normally opened or closed. To configure for normally closed operation, do not clip the jumper. To configure for normally open operation, clip the jumper.

5.4 - Deluxe D control DIP switches

The Deluxe D control has 2 DIP switch blocks. Each DIP switch block has 8 switches and is labelled either S1 or S2 on the circuit board (see Figs. 11 and 12).

DIP switch block 1 (S1) - This set of switches offers the following options for Deluxe D control configuration:
Performance Monitor (PM): Set switch 1 to enable or disable performance monitor. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.
Compressor relay staging operation: Switch 2 will enable or disable compressor relay staging operation. The compressor relay can be set to turn on with stage 1 or stage 2 call from the thermostat. This setting is used with dual stage units (units with 2 compressors and 2 Deluxe D controls) or in master/slave applications. In master/slave applications, each compressor and fan will stage according to its switch 2 setting. If switch is set to stage 2, the compressor will have a 3-second delay before energising during stage 2 demand.

NOTE: If DIP switch is set for stage 2, the alarm relay will not cycle during Test mode.

Heating/cooling thermostat type: Switch 3 provides selection of thermostat type. Heat pump or heat/cool thermostats can be selected. Select OFF for heat/cool thermostats. When in heat/cool mode, Y1 is used for cooling stage 1, Y2 is used for cooling stage 2, W1 is used for heating stage 1 and O/W2 is used for heating stage 2. Select ON for heat pump applications. In heat pump mode, Y1 used is for compressor stage 1, Y2 is used for compressor stage 2, W1 is used for heating stage 3 or emergency heat, and O/W2 is used for RV (heating or cooling) depending upon switch 4 setting.
O/B thermostat type: Switch 4 provides selection for heat pump O/B thermostats. O is cooling output. B is heating output. Select ON for heat pumps with O output. Select OFF for heat pumps with B output.
Dehumidification fan mode: Switch 5 provides selection of normal or dehumidification fan mode. Select OFF for dehumidification mode. The fan speed relay will remain OFF during cooling stage 2. Select ON for normal mode. The fan speed relay will turn on during cooling stage 2 in normal mode.
Switch 6: Not used.
Boilerless operation: Switch 7 provides selection of boilerless operation and works in conjunction with switch 8. In boilerless operation mode, only the compressor is used for heating when FP1 is above the boilerless changeover temperature set by switch 8 below. Select ON for normal operation or select OFF for boilerless operation.

Boilerless changeover temperature: Switch 8 on S1 provides selection of boilerless changeover temperature set point. Select OFF for set point of 10°C or select ON for set point of 4.4°C.

If switch 8 is set for 10°C, then the compressor will be used for heating as long as the FP1 is above 10°C. The compressor will not be used for heating when the FP1 is below 10°C and the compressor will operates in emergency heat mode, staging on EH1 and EH2 to provide heat. If a thermal switch is being used instead of the FP1 thermistor, only the compressor will be used for heating mode when the FP1 terminals are closed. If the FP1 terminals are open, the compressor is not used and the control goes into emergency heat mode.

DIP switch block 2 (S2) - This set of DIP switches is used to configure accessory relay options (see Figs. 11 and 12):
Switches 1 to 3: These DIP switches provide selection of accessory 1 relay options. See Table 5 for DIP switch combinations.
Switches 4 to 6: These DIP switches provide selection of accessory 2 relay options. See Table 6 for DIP switch combinations.

Table 5 - DIP switch block S2 - accessory 1 relay options

Accessory 1 relay options	DIP switch position 1	2	3
Cycle with fan	On	On	On
Digital night setback	Off	On	On
Water valve - slow opening	On	Off	On
Outdoor air damper	On	On	Off

Note: All other DIP switch combinations are invalid.

Table 6 - DIP switch block S2 - accessory 2 relay options

Accessory 2 relay options	DIP switch position 4	5	6
Cycle with fan	On	On	On
Digital night setback	Off	On	On
Water valve - slow opening	On	Off	On
Outdoor air damper	On	On	Off

Note: All other switch combinations are invalid.

Auto dehumidification mode or high fan mode: Switch 7 provides selection of auto dehumidification fan mode or high fan mode. In auto dehumidification fan mode the fan speed relay will remain off during cooling stage 2 if terminal H is active. In high fan mode, the fan enable and fan speed relays will turn on when terminal H is active. Set the switch to ON for auto dehumidification fan mode or to OFF for high fan mode.
Switch 8: Not used.

5.5 - Deluxe D control accessory relay configurations

The following accessory relay settings are applicable for both Deluxe D controls only:

Cycle with fan - In this configuration, the relay will be ON any time the fan enable relay is on.

Cycle with compressor - In this configuration, the relay will be ON any time the compressor relay is on.

Digital night setback (NSB) - In this configuration, the relay will be ON if the NSB input is connected to ground C.

NOTE: If there are no relays configured for digital NSB, then the NSB and OVR inputs are automatically configured for mechanical operation.

Mechanical night setback - When NSB input is connected to ground C, all thermostat inputs are ignored. A thermostat setback heating call will then be connected to the OVR input. If OVR input becomes active, then the Deluxe D control will enter night low limit (NLL) staged heating mode. The NLL staged heating mode will then provide heating during the NSB period.

5.6 - Water valve (slow opening)

If relay is configured for water valve (slow opening), the relay will start 60 seconds prior to starting compressor relay.

5.7 - Outdoor air damper (OAD)

If relay is configured for OAD, the relay will normally be ON any time the fan enable relay is energised. The relay will not start for 30 minutes following a return to normal mode from NSB, when NSB is no longer connected to ground C. After 30 minutes, the relay will start if the fan enable is set to ON.

CAUTION: To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless anti-freeze is added to system water. Condenser coils never fully drain by themselves and will freeze unless winterised with anti-freeze.

6 - START-UP

Use the procedure outlined below to initiate proper unit start-up.

NOTE: This equipment is designed for indoor installation only.

6.1 - Operating limits

Environment - This equipment is designed for indoor installation ONLY. Extreme variations in temperature, humidity and corrosive water or air will adversely affect the unit performance, reliability and service life.

Power supply - A voltage variation of ± 10% of nameplate utilisation voltage is acceptable.

Unit starting conditions - Depending on the model, units start and operate in an ambient temperature of 7.2°C with entering air temperature at 4.4°C or 10°C, entering water temperature at -6.7°C or 10°C and with both air and water at the flow rates used.

NOTE: These operating limits are not normal or continuous operating conditions. Assume that such a start-up is for the purpose of bringing the building space up to occupancy temperature. See Table 7 for operating limits.

WARNING: When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with the energised equipment.

1. Restore power to system.
2. Turn thermostat fan position to ON. Blower should start.
3. Balance air flow at registers.
4. Adjust all valves to the full open position and turn on the line power to all heat pump units.
5. Operate unit in the cooling cycle. Refer to Table 7 for unit operating limits.

NOTE: Three factors determine the operating limits of a unit: (1) entering air temperature, (2) water temperature and (3) ambient temperature. Whenever any of these factors are at a minimum or maximum level, the other two factors must be at a normal level to ensure proper unit operation (see Table 7).

Table 7 - Operating limits - 50RHE units

Air limits	Cooling °C	Heating °C
Min. ambient air temperature	7.2	7.2
Rated ambient air temperature	26.7	21.1
Max. ambient air temperature	37.8	29.4
Min. entering air temperature	10	4.4
Rated entering air temperature db/wb	27/19	20/15
Max. entering air temperature db/wb	43.3/28.3	27
Water limits	**Cooling °C**	**Heating °C**
Min. entering water temperature	-1.1	-6.7
Normal entering water temperature	10 to 32	-1.1 to 15.6

Legend
db - dry bulb
wb - wet bulb

Note: Value in heating column is dry bulb only. Any wet bulb reading is acceptable.

6.2 - Scroll compressor rotation

It is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges to suction and discharge pressure fittings.
2. Energise the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Turn off power to the unit. Install disconnect tag.
2. Reverse any two of the unit power leads.
3. Reapply power to the unit and verify pressures are correct.

The suction and discharge pressure levels should now move to their normal start-up levels.

When the compressor is rotating in the wrong direction, the unit makes more noise and does not provide cooling.

After a few minutes of reverse operation, the scroll compressor internal overload protection will open, thus activating the unit lockout. This requires a manual reset. To reset, turn the thermostat on and then off.

NOTE: There is a 5-minute time delay before the compressor will start.

6.3 - Unit start-up cooling mode

1. Adjust the unit thermostat to the warmest position. Slowly reduce the thermostat position until the compressor activates.
2. Check for cool air delivery at unit grille a few minutes after the unit has begun to operate.
3. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using P/T plugs (see Table 8). Check the elevation and cleanliness of the condensate lines; any dripping could be a sign of a blocked line. Be sure the condensate trap includes a water seal.
4. Check the temperature of both supply and discharge water. Compare with Table 9. If temperature is within range, proceed. If temperature is outside the range, check the cooling refrigerant pressures in Table 9.
5. Check air temperature drop across the coil when compressor is operating. Air temperature drop should be between 8.3 and 13.9 K.

Table 8 - Water temperature change through heat exchanger

Water flow rate l/s	Cooling rise K		Heating drop K	
	Min.	Max.	Min.	Max.
For closed loop: ground source or cooling/boiler systems at 0.054 l/s per kW	5	6.7	2.2	4.4
For open loop: ground water systems 0.027 l/s per kW	11.1	14.4	5.6	9.4

6.4 - Unit start-up heating mode

NOTE: Operate the unit in heating cycle after checking the cooling cycle. Allow five minutes between tests for the pressure or reversing valve to equalise.

1. Turn thermostat to lowest setting and set thermostat switch to HEAT position.
2. Slowly turn the thermostat to a higher temperature until the compressor activates.
3. Check for warm air delivery at the unit grille within a few minutes after the unit has begun to operate.
4. Check the temperature of both supply and discharge water. Compare with Table 9. If temperature is within range, proceed. If temperature is outside the range, check the heating refrigerant pressures in Table 9.
5. Once the unit has begun to run, check for warm air delivery at the unit grille.
6. Check air temperature rise across the coil when compressor is operating. Air temperature rise should be between 11.1 and 16.7 K after 15 minutes at load.
7. Check for vibration, noise and water leaks.

6.5 - Flow regulation

Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined (see Table 10). Adjust the water control valve until the flow of 0.027 to 0.054 l/s per kW cooling is achieved. Since the pressure constantly varies, two pressure gauges may be needed in some applications.

An alternative method is to install a flow control device. These devices are typically an orifice of plastic material designed to allow a specified flow rate that are mounted on the outlet of the water control valve. Occasionally these valves produce a velocity noise that can be reduced by applying some back pressure. To accomplish this, slightly close the leaving isolation valve of the well water set-up.

WARNING: To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position before flushing system.

Table 9 - Typical unit operating pressures and temperatures

Entering water temp. °C	Water flow l/s per kW	Cooling						Heating					
		Suction pressure kPa	Discharge pressure kPa	Super-heat K	Sub-cooling K	Water temp. rise K	Air temp. drop K	Suction pressure kPa	Discharge pressure kPa	Super-heat K	Sub-cooling K	Water temp. drop K	Air temp. rise K
-1	0.027	225-254	269-314	14-22	7-11	12-13	12-14	102-117	499-556	7- 9	1-2	4-5	8-11
	0.041	222-251	239-284	14-22	6-10	7- 9	12-14	111-129	514-571	7- 9	1-2	3-4	9-12
	0.054	219-248	209-254	14-22	6- 9	3- 6	12-14	120-138	529-586	7- 9	1-2	2-3	9-12
10	0.027	225-254	374-463	7-11	6-10	11-13	11-14	150-179	538-628	6- 9	1-3	6-7	13-16
	0.041	222-251	359-425	7-11	5- 9	7- 8	11-14	158-185	553-643	6- 9	1-3	4-5	13-17
	0.054	219-248	344-413	7-11	4- 8	4- 7	11-14	164-194	568-658	6- 9	1-3	3-4	14-17
21	0.027	225-254	535-592	5- 9	4- 8	11-12	11-13	212-245	613-688	8-11	1-3	8-9	16-19
	0.041	222-251	502-556	5- 9	4- 7	7- 9	11-13	218-254	628-712	8-11	1-3	5-6	17-21
	0.054	219-248	472-523	5- 9	4- 7	4- 7	11-13	227-263	643-724	8-11	1-3	3-4	17-21
32	0.027	225-254	685-750	5- 9	4- 8	10-12	9-13	254-284	658-777	10-16	1-3	8-9	18-22
	0.041	222-251	652-721	5- 9	4- 7	6- 8	9-13	269-299	673-792	10-16	1-3	6-7	18-23
	0.054	219-248	622-688	5- 9	4- 7	3- 6	9-13	284-314	688-807	10-16	1-3	4-5	19-23
43	0.027	231-260	837-957	4- 8	6-14	9-11	8-11						
	0.041	228-257	807-927	4- 8	6-13	5- 7	8-11						
	0.054	225-254	777-897	4- 8	6-12	3- 6	8-11						

Notes:
1. Based on nominal 54 l/s per kW air flow and 21°C entering air temperature heating and 26.7/19.4°C entering air temperature cooling.
2. Cooling air and water numbers can vary greatly with changes in humidity.
3. Subcooling is based upon the head pressure at compressor service port.

Table 10 - 50RHE tube-in-tube water pressure drop

50RHE	Flow l/s	Pressure drop, kPa 0°C	10°C	20°C	30°C
006	0.047	6.0	5.4	5.1	4.8
	0.071	8.4	7.8	7.2	6.9
	0.095	14.1	13.2	12.0	11.7
009	0.071	8.1	7.5	6.9	6.6
	0.107	12.0	11.1	10.5	9.9
	0.139	23.9	22.4	20.9	20.0
012	0.095	19.1	17.9	16.7	16.1
	0.145	41.3	38.9	36.2	34.7
	0.189	66.1	61.9	57.7	55.0
015	0.114	16.7	15.5	14.7	14.1
	0.164	32.6	30.5	28.7	27.2
	0.221	55.9	52.3	48.7	46.3
019	0.142	12.9	12.0	11.1	10.8
	0.215	23.0	21.5	20.3	19.1
	0.284	45.4	42.5	39.8	37.7
024	0.189	13.8	12.6	11.7	11.4
	0.284	28.7	26.9	25.1	23.9
	0.379	47.8	44.9	41.9	39.8
030	0.237	9.9	9.0	8.4	8.1
	0.347	17.0	15.8	14.7	14.1
	0.473	26.9	25.4	23.6	22.4
036	0.284	7.8	7.2	6.9	6.6
	0.426	15.0	13.8	12.9	12.3
	0.568	23.9	22.4	20.9	20.0
042	0.331	9.9	9.3	8.7	8.4
	0.498	19.7	18.5	17.0	16.4
	0.663	31.1	29.3	27.5	26.0
048	0.379	14.1	13.2	12.3	11.7
	0.568	26.9	25.4	23.6	22.4
	0.757	44.0	41.0	38.3	36.5
060	0.473	33.5	31.4	29.3	27.8
	0.713	58.3	54.4	50.8	48.4
	0.947	88.5	82.8	77.1	73.3

6.6 - Flushing

Once the piping is complete, units require final purging and loop charging. A flush cart pump of at least 1.12 kW is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop. Flush the loop in both directions with a high volume of water at a high velocity. Follow the steps below to flush the loop properly:

1. Verify power is off.
2. Fill loop with water from hose through flush cart before using flush cart pump to ensure an even fill. Do not allow the water level in the flush cart tank to drop below the pump inlet line to prevent air from filling the line.
3. Maintain a fluid level in the tank above the return tee to avoid air entering back into the fluid.
4. Shutting off the return valve that connects into the flush cart reservoir will allow 345 kPa surges to help purge air pockets. This maintains the pump at 345 kPa.
5. To purge, keep the pump at 345 kPa until maximum pumping pressure is reached.
6. Open the return valve to send a pressure surge through the loop to purge any air pockets in the piping system.
7. A noticeable drop in fluid level will be seen in the flush cart tank. This is the only indication of air in the loop.

NOTE: If air is purged from the system while using a 254 mm PVC flush tank, the level drop will only be 25 to 51 mm since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop. If level is less than 25 to 51 mm, reverse the flow.

8. Repeat this procedure until all air is purged.
9. Restore power.

Anti-freeze may be added before, during or after the flushing process. However, depending on when it is added in the process, it can be wasted. Refer to the anti-freeze section for more detail.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the warmer months. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for several minutes to condition the loop to a homogenous temperature.

When complete, perform a final flush and pressurise the loop to a static pressure of 275 to 345 kPa for winter months or 105 to 135 kPa for summer months.

After pressurisation, be sure to remove the plug from the end of the loop pump motor(s) to allow trapped air to be discharged and to ensure the motor housing has been flooded. Be sure the loop flow centre provides adequate flow through the unit by checking pressure drop across the heat exchanger. Compare the results to the data in Table 10.

6.7 - Anti-freeze

In areas where entering loop temperatures drop below 4.4°C or where piping will be routed through areas subject to freezing, anti-freeze is needed.

Alcohols and glycols are commonly used as anti-freeze agents. Freeze protection should be maintained to 8.3 K below the lowest expected entering loop temperature. For example, if the lowest expected entering loop temperature is -1.1°C, the leaving loop temperature would be -5.6 to -3.9°C. Therefore, the freeze protection should be at -9.4°C (-1.1°C -8.3°C = -9.4°C).

IMPORTANT: All alcohols should be pre-mixed and pumped from a reservoir outside of the building or introduced under water level to prevent fuming.

Calculate the total volume of fluid in the piping system (see Table 11). Use the percentage by volume in Table 12 to determine the amount of anti-freeze to use. Anti-freeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

6.7.1 - Freeze protection selection

The -1.1°C FP1 factory setting (water) should be used to avoid freeze damage to the unit.

Once anti-freeze is selected, the JW3 jumper (FP1) should be clipped on the control to select the low temperature (anti-freeze 13 F) set point to avoid nuisance faults.

Table 11 - Approximate fluid volume (l) per 30 m of pipe

Pipe	Diameter, in	Volume, l
Copper	1	15.5
	1.25	24.2
	1.5	34.8
Rubber hose	1	14.7
Polyethylene	3/4 IPS SDR11	10.6
	1 IPS SDR11	17.0
	1-1/4 IPS SDR11	30.0
	1/2 IPS SDR11	41.2
	2 IPS SDR11	68.1
	1-1/4 IPS SCH40	31.4
	1-1/2 IPS SCH40	41.2
	2 IPS SCH40	64.3

Legend
IPS - Internal pipe size
SCH - Schedule
SDR - Standard dimensional ratio

Note: Volume of heat exchanger is approximately 3.78 litres.

Table 12 - Anti-freeze percentages by volume

Anti-freeze	Minimum temperature for freeze protection, °C			
	-12	-9	-7	-4
Methanol (%)	25	21	16	10
100% USP food grade Propylene glycol (%)	38	30	22	15

6.8 - Cooling tower/boiler systems

These systems typically use a common loop temperature maintained at 15.6 to 32.2°C. Carrier recommends using a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary. The optional cupronickel heat exchanger must also be used in this case.

6.9 - Ground coupled, closed loop and plateframe heat exchanger well systems

These systems allow water temperatures from -1.1 to 43.3°C. The external loop field is divided up into 51 mm polyethylene supply and return lines. Each line has valves connected in such a way that upon system start-up, each line can be isolated for flushing using only the system pumps. Locate air separation in the piping system prior to the fluid re-entering the loop field.

7 - OPERATION

7.1 - Power up mode

The unit will not operate until all the inputs, terminals and safety controls are checked for normal operation.

NOTE: The compressor will have a 5-minute anti-short cycle upon power up.

7.2 - Units with Aquazone Complete C control

7.2.1 - Standby
Y and W terminals are not active in standby mode, however the O and G terminals may be active, depending on the application. The compressor will be off.

7.2.2 - Cooling
Y and O terminals are active in cooling mode. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energised.

NOTE: On all subsequent compressor calls the random start delay is omitted.

7.2.3 - Heating stage 1
Terminal Y is active in heating stage 1. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energised.

NOTE: On all subsequent compressor calls the random start delay is omitted.

7.2.4 - Heating stage 2
To enter stage 2 mode, terminal W is active (Y is already active). Also, the G terminal must be active or the W terminal is disregarded. The compressor relay will remain on and EH1 is immediately turned on. EH2 will turn on after 10 minutes of continual stage 2 demand.

NOTE: EH2 will not turn on (or if on, will turn off) if FP1 temperature is greater than 7.2°C and FP2 is greater than 43.3°C.

7.2.5 - Emergency heat
In emergency heat mode, terminal W is active while terminal Y is not. Terminal G must be active or the W terminal is disregarded. EH1 is immediately turned on. EH2 will turn on after 5 minutes of continual emergency heat demand.

7.3 - Units with Aquazone Deluxe D control

7.3.1 - Standby/fan only
The compressor will be off. The fan enable, fan speed and reversing valve (RV) relays will be on if inputs are present. If there is a fan 1 demand, the fan enable will immediately turn on. If there is a fan 2 demand, the fan enable and fan speed will immediately turn on.

NOTE: DIP switch 5 on S1 does not have an effect upon fan 1 and fan 2 outputs.

7.3.2 - Heating stage 1
In heating stage 1 mode, the fan enable and compressor relays are turned on immediately. Once the demand is removed, the relays are turned off and the control reverts to standby mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

7.3.3 - Heating stage 2
In heating stage 2 mode, the fan enable and compressor relays are remain on. The fan speed relay is turned on immediately and turned off immediately once the demand is removed. The control reverts to heating stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

7.3.4 - Heating stage 3
In heating stage 3 mode, the fan enable, fan speed and compressor relays remain on. The EH1 output is turned on immediately. With continuing heat stage 3 demand, EH2 will turn on after 10 minutes. EH1 and EH2 are turned off immediately when the heating stage 3 demand is removed. The control reverts to heating stage 2 mode.

Output EH2 will be off if FP1 is greater than 7.2°C and FP2 (when shorted) is greater than 43.3°C during heating stage 3 mode. This condition will have a 30-second recognition time. Also, during heating stage 3 mode, EH1, EH2, fan enable and fan speed will be ON if G input is not active.

7.3.5 - Emergency heat
In emergency heat mode, the fan enable and fan speed relays are turned on. The EH1 output is turned on immediately. With continuing emergency heat demand, EH2 will turn on after 5 minutes. Fan enable and fan speed relays are turned off after a 60-second delay. The control reverts to standby mode.

Output EH1, EH2, fan enable and fan speed will be ON if the G input is not active during emergency heat mode.

7.3.6 - Cooling stage 1
In cooling stage 1 mode, the fan enable, compressor and RV relays are turned on immediately. If configured as stage 2 (DIP switch set to OFF) then the compressor and fan will not turn on until there is a stage 2 demand. The fan enable and compressor relays are turned off immediately when the cooling stage 1 demand is removed. The control reverts to standby mode. The RV relay remains on until there is a heating demand. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

7.3.7 - Cooling stage 2
In cooling stage 2 mode, the fan enable, compressor and RV relays remain on. The fan speed relay is turned on immediately and turned off immediately once the cooling stage 2 demand is removed. The control reverts to cooling stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

7.3.8 - Night low limit (NLL) staged heating
In NLL staged heating mode, the override (OVR) input becomes active and is recognised as a call for heating and the control will immediately go into a heating stage 1 mode. With an additional 30 minutes of NLL demand, the control will go into heating stage 2 mode. With another additional 30 minutes of NLL demand, the control will go into heating stage 3 mode.

8 - SYSTEM TEST

System testing provides the ability to check the control operation. The control enters a 20-minute test mode by momentarily shorting the test pins (see Figs. 9-12). All time delays are reduced by a factor of 15.

8.1 - Test mode

To enter test mode on C or D controls, cycle the power 3 times within 60 seconds. The LED (light-emitting diode) will flash a code representing the last fault when entering the test mode. The alarm relay will also power on and off during test mode (see Tables 13 and 14). To exit test mode, short the terminals for 3 seconds or cycle the power 3 times within 60 seconds.

NOTE: Deluxe D control has a flashing code and alarm relay cycling code that will both have the same numerical label. For example, flashing code 1 will have an alarm relay cycling code 1. Code 1 indicates the control has not faulted since the last power off to power on sequence.

Table 13 - C control current LED status and alarm relay operations

LED status	Description of operation	Alarm relay
On	Normal mode Normal mode with PM warning	Open Cycle (closed 5 sec., open 25 sec.)
Off	C control is non-functional	Open
Slow flash	Fault retry	Open
Fast flash	Lockout	Closed
Slow flash	Over/under voltage shutdown	Open (closed after 15 minutes)
Flashing code 1	Test mode - No fault in memory	Cycling code 1
Flashing code 2	Test mode - HP fault in memory	Cycling code 2
Flashing code 3	Test mode - LP fault in memory	Cycling code 3
Flashing code 4	Test mode - FP1 fault in memory	Cycling code 4
Flashing code 5	Test mode - FP2 fault in memory	Cycling code 5
Flashing code 6	Test mode - CO fault in memory	Cycling code 6
Flashing code 7	Test mode - Over/under shutdown in memory	Cycling code 7
Flashing code 8	Test mode - PM in memory	Cycling code 8
Flashing code 9	Test mode - FP1/FP2 swapped fault in memory	Cycling code 9

Legend
CO - Condensate overflow
FP - Freeze protection
HP - High pressure
LED - Light-emitting diode
LP - Low pressure
PM - Performance Monitor

Notes:
1. Slow flash is 1 flash every 2 seconds.
2. Fast flash is 2 flashes every 1 second.
3. EXAMPLE: “Flashing code 2” is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

Table 14 - C control LED code and fault descriptions

LED code	Fault	Description
1	No fault in memory	There has been no fault since the last power-down to power-up sequence
2	High pressure switch	HP open instantly
3	Low pressure switch	LP open for 30 continuous seconds before or during a call (bypassed for first 60 seconds)
4	Freeze protection coax - FP1	FP1 below temp. limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
5	Freeze protection air coil - FP2	FP2 below temp. limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
6	Condensate overflow	Sense overflow (grounded) for 30 continuous seconds
7 (Autoreset)	Over/under voltage shutdown	“R” power supply is <19 V a.c. or >30 V a.c.
8	PM warning	Performance Monitor warning has occurred
9	FP1 and FP2 thermistors are swapped	FP1 temperature is higher than FP2 in heating/test mode, or FP2 temperature is higher than FP1 in cooling/test mode.

Legend
FP - Freeze protection
HP - High pressure
LED - Light-emitting diode
LP - Low pressure
PM - Performance Monitor

8.2 - Retry mode

In retry mode, the status LED will start to flash slowly to signal that the control is trying to recover from an input fault. The control will stage off the outputs and try to again satisfy the thermostat used to terminal Y. Once the thermostat input calls are satisfied, the control will continue normal operation.

NOTE: If 3 consecutive faults occur without satisfying the thermostat input call to terminal Y, the control will go into lockout mode. The last fault causing the lockout is stored in memory and can be viewed by entering test mode.

8.3 - Aquazone Deluxe D control LED indicators

There are 3 LED indicators on the D control:

Status LED - Status LED indicates the current status or mode of the D control. The status LED light is green.

Test LED - Test LED will be activated any time the D control is in test mode. The test LED light is yellow.

Fault LED - Fault LED light is red. The fault LED will always flash a code representing the last fault in memory. If there is no fault in memory, the fault LED will flash code 1 on the control and appear as 1 fast flash alternating with a 10-second pause (see Table 15).

Table 15 - Aquazone D control current LED status and alarm relay operations

Description	Status LED (Green)	Test LED (Yellow)	Fault LED (Red)	Alarm relay
Normal mode	On	Off	Flash last fault code in memory	Open
Normal mode with PM ...)	On	Off	Flashing code 8	Cycle (closed 5 sec, open 25 sec,
D control is non-functional	Off	Off	Off	Open
Test mode	-	On	Flash last fault code in memory	Cycling appropriate code
Night setback	Flashing code 2	-	Flash last fault code in memory	-
ESD	Flashing code 3	-	Flash last fault code in memory	-
Invalid T-stat inputs	Flashing code 4	-	Flash last fault code in memory	-
No fault in memory	On	Off	Flashing code 1	Open
HP fault	Slow flash	Off	Flashing code 2	Open
LP fault	Slow flash	Off	Flashing code 3	Open
FP1 fault	Slow flash	Off	Flashing code 4	Open
FP2 fault	Slow flash	Off	Flashing code 5	Open
CO fault	Slow flash	Off	Flashing code 6	Open
Over/under voltage	Slow flash	Off	Flashing code 7	Open (closed after 15 minutes)
HP lockout	Fast flash	Off	Flashing code 2	Closed
LP lockout	Fast flash	Off	Flashing code 3	Closed
FP1 lockout	Fast flash	Off	Flashing code 4	Closed
FP2 lockout	Fast flash	Off	Flashing code 5	Closed
CO lockout	Fast flash	Off	Flashing code 6	Closed

Legend
CO - Condensate overflow
ESD - Emergency shutdown
FP - Freeze protection
HP - High pressure
LP - Low pressure
PM - Performance Monitor

Notes:
1. If there is no fault in memory, the fault LED will flash code 1.
2. Codes will be displayed with a 10-second fault LED pause.
3. Slow flash is 1 flash every 2 seconds.
4. Fast flash is 2 flashes every 1 second.
5. EXAMPLE: “Flashing code 2” is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

9 - SERVICE

Perform the procedures outlined below periodically, as indicated.

IMPORTANT: When a compressor is removed from this unit, system refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, the refrigerant lines of the compressor must be sealed after it is removed.

IMPORTANT: All refrigerant discharged from this unit must be recovered without exception. Technicians must follow industry-accepted guidelines and all local, state and federal statutes for the recovery and disposal of refrigerants.

IMPORTANT: To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must only be serviced by technicians which meet local and national proficiency requirements.

IMPORTANT: To prevent injury or death due to electrical shock or contact with moving parts, open unit disconnect switch before servicing unit.

9.1 - Filters

Filters must be clean for maximum performance. Inspect filters every month under normal operating conditions. Replace when necessary.

IMPORTANT: Units should never be operated without a filter.

9.2 - Water coil

Keep all air out of the water coil. Check open loop systems to be sure the well head is not allowing air to infiltrate the water line. Always keep lines airtight.

Inspect heat exchangers regularly, and clean more frequently if the unit is located in a “dirty” environment. Keep the heat exchanger full of water at all times. Open loop systems should have an inverted P trap placed in the discharge line to keep water in the heat exchanger during off cycles. Closed loop systems must have a minimum of 105 kPa during the summer and 275 kPa during the winter.

Check P trap frequently for proper operation.

CAUTION: To avoid fouled machinery and extensive unit clean-up, DO NOT operate units without filters in place. DO NOT use equipment as a temporary heat source during construction.

9.3 - Condensate drain pans

Check condensate drain pans for algae growth twice a year. If algae growth is apparent, consult a water treatment specialist for proper chemical treatment. Applying an algaecide every three months will typically eliminate algae problems in most locations.

9.4 - Refrigerant system

Verify air and water flow rates are at proper levels before servicing. To maintain sealed circuitry integrity, do not install service gauges unless unit operation appears abnormal.

Check to see that unit is within the superheat and subcooling temperature ranges shown in Table 16. If the unit is not within these ranges, recover and reweigh in refrigerant charge.

9.5 - Condensate drain cleaning

Clean the drain line and unit drain pan at the start of each cooling season. Check flow by pouring water into drain. Be sure trap is filled to maintain an air seal.

9.6 - Air coil cleaning

Remove dirt and debris from evaporator coil as required by condition of the coil. Clean coil with a stiff brush, vacuum cleaner, or compressed air. Use a fin comb of the correct tooth spacing when straightening mashed or bent coil fins.

9.7 - Condenser cleaning

Water-cooled condensers may require cleaning of scale (water deposits) due to improperly maintained closed-loop water systems. Sludge build-up may need to be cleaned in an open water tower system due to induced contaminants.

Local water conditions may cause excessive fouling or pitting of tubes. Condenser tubes should therefore be cleaned at least once a year, or more often if the water is contaminated.

Proper water treatment can minimise tube fouling and pitting. If such conditions are anticipated, water treatment analysis is recommended. Refer to the Carrier System Design Manual, Part 5, for general water conditioning information.

CAUTION: Follow all safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution. Observe and follow acid manufacturer's instructions.

Clean condensers with an inhibited hydrochloric acid solution. The acid can stain hands and clothing, damage concrete, and, without inhibitor, damage steel. Cover surroundings to guard against splashing. Vapours from vent pipe are not harmful, but take care to prevent liquid from being carried over by the gases.

Warm solution acts faster, but cold solution is just as effective if applied for a longer period.

9.7.1 - Gravity flow method

Do not add solution faster than vent can exhaust the generated gases.

When condenser is full, allow solution to remain overnight, then drain condenser and flush with clean water. Follow acid manufacturer's instructions (see Fig. 18).

9.7.2 - Forced circulation method

Fully open vent pipe when filling condenser. The vent may be closed when condenser is full and pump is operating (see Fig. 19).

Regulate flow to condenser with a supply line valve. If pump is a non-overloading type, the valve may be fully-closed while pump is running.

For average scale deposit, allow solution to remain in condenser overnight. For heavy scale deposit, allow 24 hours. Drain condenser and flush with clean water. Follow acid manufacturer's instructions.

Fig. 18 - Gravity flow method

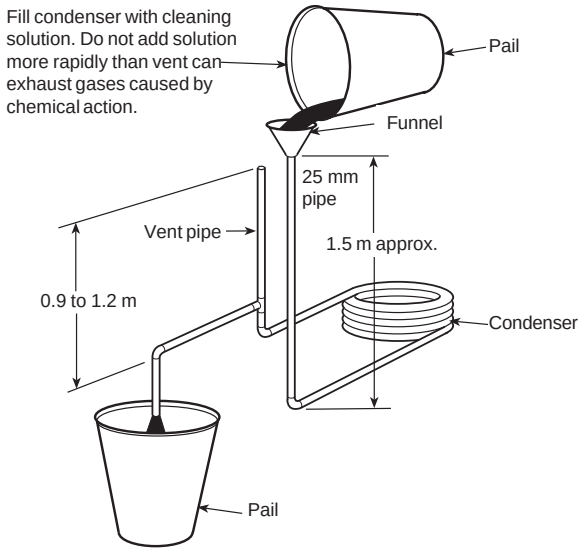
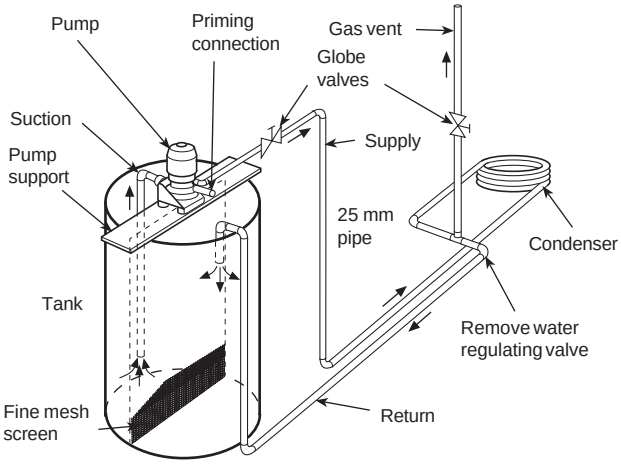

Fill condenser with cleaning solution. Do not add solution more rapidly than vent can exhaust gases caused by chemical action.
Pail
Funnel
25 mm pipe
Vent pipe
1.5 m approx.
0.9 to 1.2 m
Condenser
Pail

Fig. 19 - Forced circulation method



9.8 - Checking system charge

Units are shipped with full operating charge. If recharging is necessary:

1. Insert thermometer bulb in insulating rubber sleeve on liquid line near filter drier. Use a digital thermometer for all temperature measurements. DO NOT use a mercury or dial-type thermometer.
2. Connect pressure gauge to discharge line near compressor.
3. After unit conditions have stabilised, read head pressure on discharge line gauge.

NOTE: Operate unit a minimum of 15 minutes before checking charge.

4. From standard field-supplied pressure-temperature chart for R-407C, find equivalent bubble point temperature.
5. Read liquid line temperature on thermometer; then subtract from bubble point temperature. The difference equals subcooling temperature.

6. Compare the subcooling temperature with the normal temperature listed in Table 9. If the measured liquid line temperature does not agree with the required liquid line temperature, ADD refrigerant to raise the temperature or REMOVE refrigerant (using standard practices) to lower the temperature (allow a tolerance of ± 1.7 K).

9.9 - Refrigerant charging

WARNING: To prevent personal injury, wear safety glasses and gloves when handling refrigerant. Do not overcharge system - this can cause compressor flooding.

NOTE: Do not vent or depressurise unit refrigerant to atmosphere. Remove and reclaim refrigerant following accepted practices.

9.10 - Air coil fan motor removal

CAUTION: Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

Disconnect motor power wires from motor terminals before motor is removed from unit.

1. Shut off unit main power supply.
2. Loosen bolts on mounting bracket so that fan belt can be removed.
3. Loosen and remove the 2 motor mounting bracket bolts on left side of bracket.
4. Slide motor/bracket assembly to extreme right and lift out through space between fan scroll and side frame. Rest motor on a high platform such as a step ladder. Do not allow motor to hang by its power wires.

10 - TROUBLESHOOTING (Figs. 20 and 21 and Table 16)

When troubleshooting problems with a water-source heat pump, consider the following.

10.1 - Thermistor

A thermistor may be required for single-phase units where starting the unit is a problem due to low voltage. (See Fig. 20 for thermistor nominal resistance.)

10.2 - Control sensors

The control system employs 2 nominal 10,000 ohm thermistors (FP1 and FP2) that are used for freeze protection. Be sure FP1 is located in the discharge fluid and FP2 is located in the air discharge (see Fig. 21).

Fig. 20 - Thermistor nominal resistance

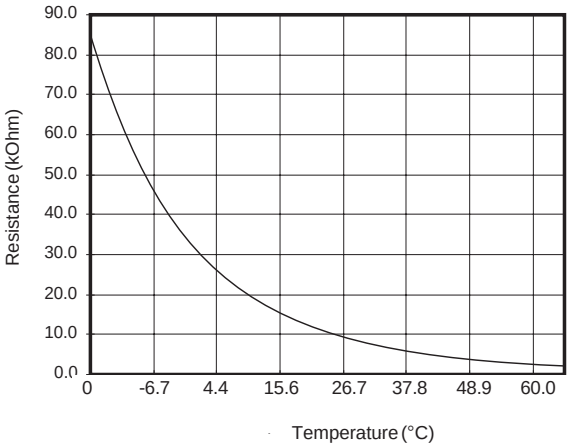


Fig. 21 - FP1 and FP2 thermistor location

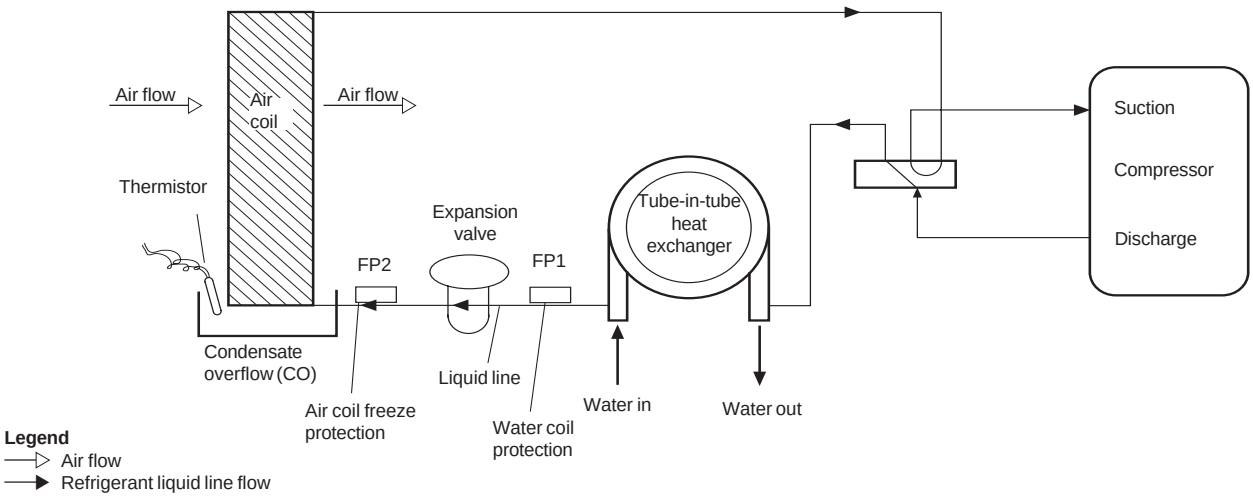


Table 16 - Troubleshooting

Fault	Heating	Cooling	Possible cause	Solution
Main power problems	X	X	Green status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24 V a.c. between R and C on controller.
				Check primary/secondary voltage on transformer.
HP fault - code 2		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
High pressure				Check water flow adjust to proper flow rate.
		X	Water temperature out of range in cooling	Bring water temperature within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty air coil - construction dust etc.
				External static too high. Check Table 4.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition Table 9.
	X	X	Bad HP switch	Check switch continuity and operation. Replace.
LP/LOC fault - code 3	X	X	Insufficient charge	Check for refrigerant leaks.
Low pressure/loss of charge	X		Compressor pump down at start-up	Check charge and start-up water flow.
FP1 fault - code 4	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
Water freeze protection				Plugged strainer or filter. Clean or replace.
				Check water flow adjust to proper flow rate.
	X		Inadequate anti-freeze level	Check anti-freeze density with hydrometer.
	X		Improper freeze protect setting (-1.1°C vs -12.2°C)	Clip JW2 jumper for anti-freeze (-12.2°C) use.
	X		Water temperature out of range	Bring water temperature within design parameters.
	X	X	Bad thermistor	Check temperature and impedance correlation.
FP2 fault - code 5		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
Air coil freeze protection				Check fan motor operation and airflow restrictions.
				External static too high. Check Table 4.
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
		X	Improper freeze protect setting (-1.1°C vs -12.2°C)	Normal airside applications will require -1.1°C only.
	X	X	Bad thermistor	Check temperature and impedance correlation.
Condensate fault - code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting. Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
Over/under voltage - code 7	X	X	Under voltage	Check power supply and 24 V a.c. voltage before and during operation.
(Auto resetting)				Check power supply wire size.
				Check compressor starting.
				Check 24 V a.c. and unit transformer tap for correct power supply voltage.
	X	X	Over voltage	Check power supply voltage and 24 V a.c. before and during operation.
				Check 24 V a.c. and unit transformer tap for correct power supply voltage.
Performance Monitor -	X		Heating mode FP2> 51.7°C	Check for poor airflow or overcharged unit.
code 8		X	Cooling mode FP1> 51.7°C or FP2< 4.4°C	Check for poor water flow or airflow.
FP1 and FP2 thermistors - code 9	X		FP1 temperature is higher than FP2 temperature.	Swap FP1 and FP2 thermistors.
		X	FP2 temperature is higher than FP1 temperature.	Swap FP1 and FP2 thermistors.
No fault code shown	X	X	No compressor operation	See scroll compressor rotation section.
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.
Unit short cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in 'Test Mode'	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace if necessary.
Only fan runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in test mode.

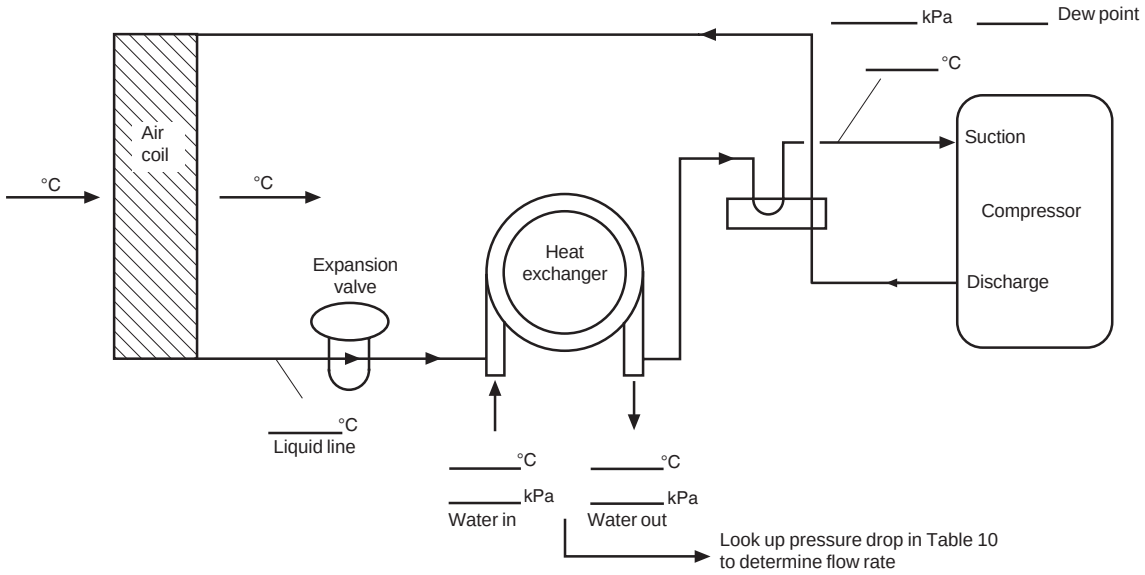
Legend
RV - Reversing valve

Table 16 - Troubleshooting (cont'd)

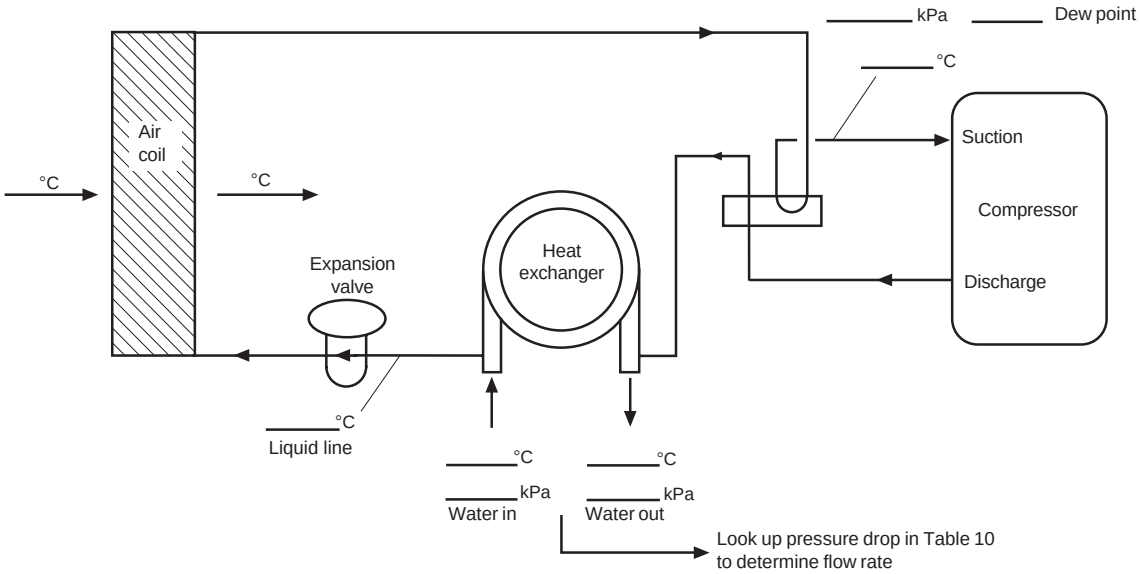
Fault	Heating	Cooling	Possible cause	Solution
Only compressor runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts.
				Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in Test mode.
Unit does not operate in cooling		X	Reversing valve	Set for cooling demand and check 24 V a.c. on RV coil and at control.
				If RV is stuck, run high pressure up by reducing water flow and while operating, engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'Click'.
Insufficient capacity/not cooling or heating properly	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				External static too high. Check blower Table 4.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				External static too high. Check blower Table 4.
	X	X	Leaky ductwork	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling Table 9.
	X	X	Restricted metering device	Check superheat and subcooling Table 9. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind thermostat.
	X	X	Unit undersized	Recheck loads and sizing check sensible cooling load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or cold	Check load, loop sizing, loop backfill, ground moisture.
High head pressure	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				External static too high. Check blower Table 4.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow; adjust to proper flow rate. See Table 8.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Reweigh in charge.
	X	X	Non-condensables in system	Vacuum system and reweigh in charge.
	X	X	Restricted metering device	Check superheat and subcooling per Table 9. Replace.
Low suction pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace.
				Check water flow adjust to proper flow rate.
	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				External static too high. Check blower Table 4.
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low discharge air temperature in heating	X		Too high airflow	Check blower Table 4.
	X		Poor performance	See 'Insufficient Capacity'.
High humidity		X	Too high airflow	Check blower Table 4.
		X	Unit oversized	Recheck loads and sizing check sensible cooling load and heat pump capacity.

Legend
RV - Reversing valve

Heating cycle analysis



Cooling cycle analysis



Heat of extraction (absorption) or heat of rejection =

_____ Flow rate (l/s) x _____ Temp. difference (K) x _____ Fluid factor* = $\frac{\text{\_\_\_\_\_}}{\text{(kW)}}$

Superheat = Suction temperature - suction dew point temperature
= _____ (K)

Subcooling = Discharge bubble point temperature - liquid line temperature
= _____ (K)

* Use 4.16 for water, 4.03 for anti-freeze

11 - START-UP CHECKLIST - 50RHE R-407C UNIT

Customer: _____ Job name: _____

Model No.: _____ Serial No.: _____ Date: _____

I. Pre-start-up

Does the unit voltage correspond with the supply voltage available? (Y/N) _____

Have the power and control wiring connections been made and are terminals tight? (Y/N) _____

Have the water connections been made and is fluid available at the heat exchanger? (Y/N) _____

Has the pump been turned on and are the isolation valves open? (Y/N) _____

Has the condensate connection been made and is a trap installed? (Y/N) _____

Is an air filter installed? (Y/N) _____

II. Start-up

Is the fan operating when the compressor operates? (Y/N) _____

If a 3-phase scroll compressor is present, verify proper rotation per instructions. (Y/N) _____

Unit voltage - cooling operation

Phase AB Volts _____	Phase BC Volts _____ (if 3-phase)	Phase CA Volts _____ (if 3-phase)
Phase AB Amps _____	Phase BC Amps _____ (if 3-phase)	Phase CA Amps _____ (if 3-phase)

Control voltage

Is the control voltage above 21.6 Volts? (Y/N) _____

If not, check for proper transformer connection.

Temperatures

Fill in the analysis chart attached.

Tube-in-tube heat exchanger	Cooling cycle: Fluid in _____ °C	Fluid out _____ °C	_____ kPa	_____ l/s	
	Heating cycle: Fluid in _____ °C	Fluid out _____ °C	_____ kPa	_____ l/s	
Air coil	Cooling cycle: Air in _____ °C	Air out _____ °C			
	Heating cycle: Air in _____ °C	Air out _____ °C			

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